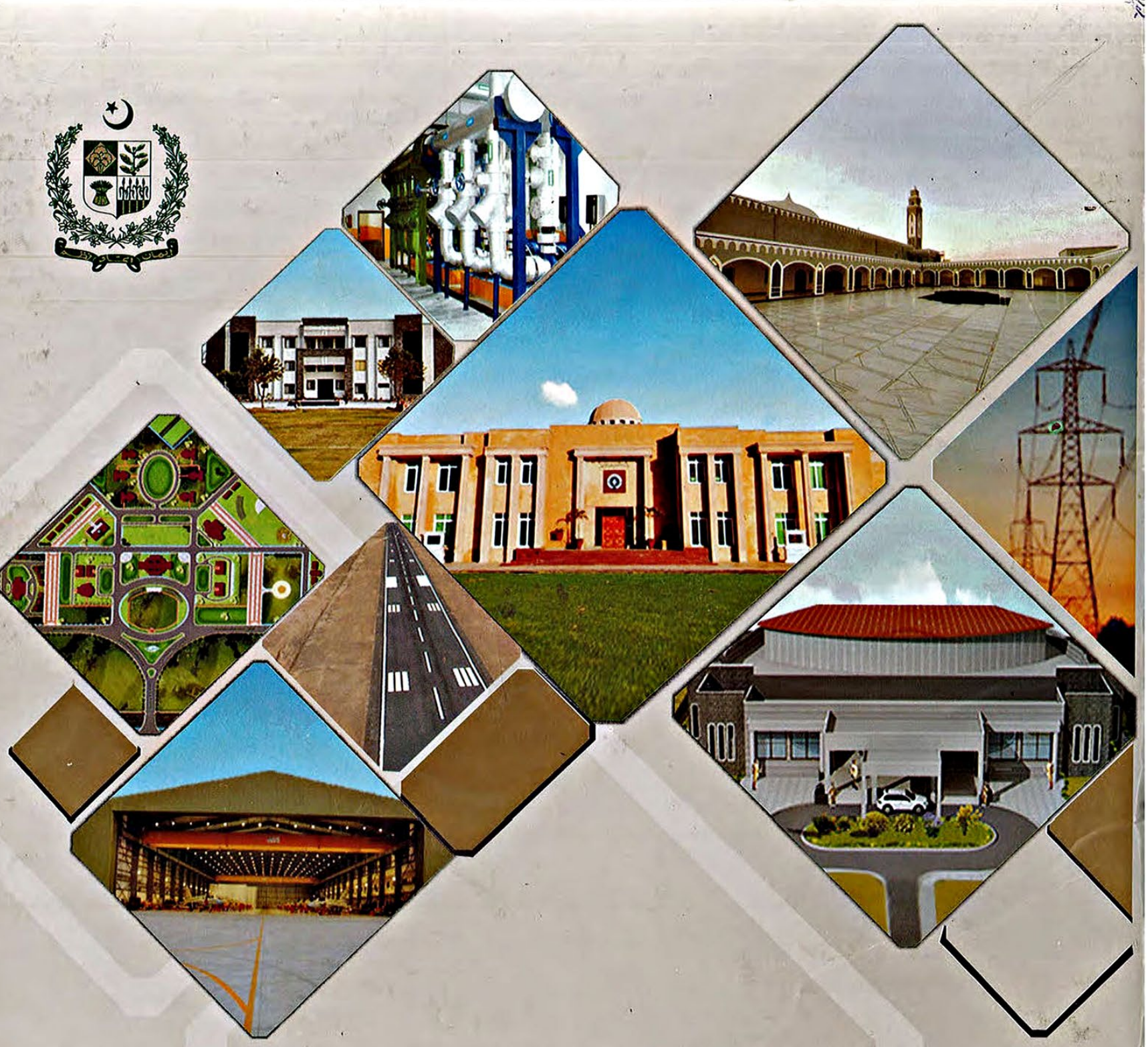


# SCHEDULE OF RATES - 2021

MILITARY ENGINEER SERVICES
PAKISTAN

# SCHEDULE OF RATES - 2021

## MILITARY ENGINEER SERVICES, PAKISTAN

SUPARCO Karachi
Libraries Division (UIQs.)
Date 08-Feb-2022
Acc No: 8462

SAJID SAMI

# MINISTRY OF DEFENCE

# MILITARY ENGINEER SERVICES, PAKISTAN

# SCHEDULE OF RATES - 2021

## FOR

## CONSTRUCTION AND MAINTENANCE WORKS

**COMPILED UNDER THE ORDERS**

**OF**

## ENGINEER-IN-CHIEF

## GENERAL HEADQUARTERS, RAWALPINDI

# IMPORTANT NOTES

All works executed and paid for under this Schedule are to be measured in accordance with instructions and remarks detailed here in, without reference to any local custom or other practice, should that differ in any way from methods used in this Schedule.

Item rates, description of materials and workmanship, modes of measurement etc, contained in all previous Schedules are to be considered as obsolete. They shall not constitute a precedent for purposes of comparison with (or interpretation of) the contents of this Schedule.

Editions of MES Schedule of Rates:

| | |
|---|---|
| First Edition | 1948 |
| Second Edition | 1961 |
| Third Edition | 1963 |
| Fourth Edition | 1970 |
| Fifth Edition | 1975 |
| Sixth Edition | 1981 |
| Seventh Edition | 1988 |
| Eighth Edition | 1993 |
| Ninth Edition | 2000 |
| Tenth Edition | 2004 |
| Eleventh Edition | 2009 |
| Twelveth Edition | 2014 |
| Thirteenth Edition | 2021 |


## Copy Rights @2021

**All Rights reserved.**

Reproduction in any form, in part or whole of this book, by an individual, department, contractor or firm etc., is ***Strictly Prohibited.***

This Schedule, however, i:nay be used by an individual or department etc., **Provided** the **Contract Agreement** makes a clear mention, that the Contract has been based on the **"MES Schedule of Rates - 2021".**

For this purpose, copies of **"MES Schedule of Rates - 2021"** are available with the **Engineer in Chief's Branch, GHQ, Rawalpindi.** Please contact at telephone number 051-9271270 and e-mail address: revpubsec@gmail.com


## Contact Information:

For any suggestion, improvements and clarifications, please contact GSO-1 (Revision & Publication) at telephone number 051-9271270 and e-mail address: revpubsec@gmail.com

**Revision Art**

"Revision is not invention, it is just making the document updated and more valid....."

**Richardrein Haas**

## PREFACE

In the last decade, construction industry has undergone huge transformation due to introduction of modern construction technologies, IT based systems, advanced practices and use of new materials. Also, after previous revision, the market experienced extreme price hike. This all necessitated a comprehensive revision of MES Schedule of Rates - 2014 to make it a comprehensive document.

In the revised Schedule of Rates, latest construction methods and materials have been added and obsolete items and practices have been deleted. An effort has been made to incorporate current market trends and contemporary aesthetics. In addition to revision of Schedule Items and corresponding rates, overall substance and contents have also been improved. Thus, this revised Schedule has become a very useful manual for planners, designers and practicing engineers as well.

New edition of Schedule of Rates have been prepared by a team of experts having huge experience of field work. Concrete efforts have been made to make this Schedule more comprehensive, modernized and futuristic, in line with the best national and international practices. The lay out and format have also been revised to afford ease of reference and efficiency.

I appreciate the professional acumen and dedication displayed by every member of the Revision Team in compiling **"MES Schedule of Rates - 2021".** I am sure this revised edition shall address most of the voids experienced in the past, and will serve as a much improved and advanced document for planning and execution of civil engineering projects entrusted to the MES, as a modern construction and maintenance organization.

Lieutenant General
Engineer-in-Chief
(Moazzam Ejaz

Rawalpindi
31 May 2021

# EXECUTIVE SUMMARY

## Need for Revision

Last edition of MES Schedule of Rates was issued in 2014. Since then, there has been an influx of new construction materials, especially artificial materials. These materials and products are manufactured using high precision and automated machinery, and are not only durable, better-finished, easy to use and less labor-intensive but are also cheaper and require minimal maintenance. Similarly, most of the construction practices e.g., production and laying of concrete has been automated through the use of mechanical means and IT systems which has resulted into reduction of effort, lesser cost and better quality. Therefore, incorporation of these new materials and contemporary construction trends in MES Schedule of Rates was the need of time to make it a comprehensive and useful document. In this backdrop, the initial scope of revision was approved by Engineer-in-Chief which included updation and modernization of technical specifications, adoption of new construction materials and practices, with built-in reasonable and rational rates.

## Revision Teams

*Technical Teams of Experts*

Two technical teams (one for B/R and one for E/M Sections), each headed by a senior Chief Engineer ex MES and comprising experienced Superintending Engineers and Executive Engineers ex MES field formations and Directorate of Design and Consultancy (DD&C), were constituted to review the existing Schedule of Rates and suggest modifications and improvements.

*Rate Collection Teams*

Officers and AEs/SDOs ex Directorate of Research & Support (DR&S) were tasked to obtain the latest rates of materials, labour and construction equipment from the market and enlisted firms.

*Technical Scrutiny Team*

An experienced scrutiny team, headed by Director Research & Support and comprising of Director Planning & Works, Director Inspection & Evaluation, Chief Engineer ex DGW&CE (Army) and a retired Chief Engineer ex MES, was constituted to finalize deletions, modifications and additions in the specifications, basis of computation of rates, and categorization of products.

*Board of Officers (B.O.O)*

A B.O.O, headed by Director Planning & Works and comprising four experts each of B/R and E/M specialty, was constituted to scrutinize both rates and specifications.

*Pre-audit*

Team of auditors ex DGADS was nominated for pre-audit of all rates and specifications.

## Scope of Revision

After initial work and presentations, E-in-C approved the following scope of work: -

(1) Deletion of obsolete materials and old practices, and incorporation of new materials and latest construction trends and technologies.

(2) Removal of brand names from MES Schedule of Rates, and categorization of schedule items and products as Standard, Deluxe and Premium.

(3) Basing rates of schedule items on the use of mechanical and automated construction technologies/ equipment and modern construction methods.

(4) Basing rates on the performance of material/ product instead of construction method/ quantities used.

(5) Inclusion of reasonable and justified rates.

## How Revision Has Been Done

Based on the above scope, work of revision was divided into two tasks and got completed as explained below:-

*Task 1: Revision of Specifications and Schedule Items in view of Contemporary Construction Trends and Practices, and Categorization of Products.*

(1) Initial review/ revision of the specifications was done by experts ex DD&C.

(2) B/R and E/M technical teams reviewed the schedule items, and suggested additions and deletions.

(3) Technical Scrutiny Team finalized all deletions, modifications and additions in specifications, basis of computation of rates, and categorization of various products as Standard, Deluxe and Premium.

(4) Thereafter, schedule items were rewritten and their description was completed by the officers and staff of DR&S.

(5) Vetting of specifications and schedule items was then done by a 8.0.0., and pre-audit was carried out by the auditors ex DGADS.

(6) Final approval of revisions was given by the Engineer-in-Chief.

*Task 2: Revision of Rates*

(1) Rates were collected from the markets of Rawalpindi and Lahore and from the firms enlisted with E-in-C Branch. Rates were also collected from manufacturers / vendors and Pakistan Bureau of Statistics for comparative purposes.

(2) Rates of each schedule items were computed by combining material, labour and equipment costs, and analyzed to ensure these are correct, rationale and reasonable.

(3) Rates were then also compared with rates given in the Schedule of Rates of NHA and Government of Punjab, and adjustments were made where needed.

(4) Four works (8 x D Type Flats, 8 x E Type Flats, 192 SM Barrack and Taxi Track Road Work) were priced on MES Schedule of Rates 2009, 2014 and 2021. Cost of these four works was compared with old schedules, prevailing ruling percentage and actual amount of CAs to check the reasonability and rationality of the new rates. Rates were reviewed where needed.

(5) Rates were then got vetted/ scrutinized from B.O.O to eliminate errors/ omissions and anomalies.

(6) Pre-audit of rates was then carried out by the auditors ex DGADS to avoid any arithmetical errors and negative financial implications.

(7) Final approval of rates was given by the Engineer-in-Chief.

**Summary of Revisions**

Many existing specifications have been revised and new specifications have been introduced. Overall change in specifications is around 48 percent.

In addition, a new section titled, "Electro Mechanical Equipment's" has been included, and existing Section on HVAC has been merged in this section. This new section includes systems and products whose specifications and cost depend on the wholesome design of these systems, and also varies hugely for the same products of different OEMs. Type of systems included in this new section are HVAC, elevators and lifts, cranes, solar systems, medical gases, public address systems and fire detection and alarm systems. Detailed specifications and rates of most of the components of these systems are included. However, in certain cases it was not possible to provide the rates as these depend on the final design of the system. Therefore, guidelines have been provided in "Supplementary Instructions to MES Schedule of Rates 2021".

***MES Schedule of Rates- 2014 had in total 6951 schedule items from which 2743 items have been deleted, 1888 new items added and 322 items have been modified.*** The revised Schedule of Rates has ***6096 items.*** New and modified items include a large variety of new materials, and are based on new trends and techniques of construction to improve quality, reduce cost and time of construction in line with contemporary practices. Overall changes in schedule items are ***71 percent.***

Further, format and style has been modified to economize on space and make it easy to refer/ use. Paragraph numbering of sub paras has been simplified. New cover page has been designed. Paper size has been increased from A-5 to A-4 and deleted schedule items have been removed to reduce the thickness of the book. Rates in revised Schedule of Rates are given as whole number to save on typing effort and to minimize intentional or unintentional typing errors.

**Concept Changes**

Many new concepts have been introduced, both for selection of products and computation of rates. Major conceptual changes are described below:-

(1) To reduce star rates, improve quality and reduce item rates, and to give equal opportunity to all, following has been done: -

(a) Brand names have been omitted, instead specifications have been defined and items have been categorized as ***Standard, Deluxe and Premium.***

(b) Imported or Pakistan made has been removed, instead specifications have been defined.

(c) Colour and texture categorization has been removed.

(d) Categorization on the basis of sizes has been removed, wherever it was possible.

(2) Materials hazardous to environment have been removed.

(3) To save the environment, use of wood is now restricted to doors, windows and partitions only.

(4) Deduction for use of 2nd class wood in place of 1st class wood has been increased from 24% to 60%.

(5) Rates are now based on output/ performance instead of method/ quantity used.

(6) Rates are based on mechanical methods/ practices instead of manual methods of construction.

**Supplementary Instructions for MES Schedule of Rates 2021**

As highlighted above, now products have been categorized as ***Standa_rd, Deluxe and Premium*** and brand names, categorization on the basis of countries of origin, texture, colour and size has been omitted in the revised schedule. Therefore, it was essential to issue an additional document for the use of field executives so that they can select the correct material / product under ***Standard, Deluxe and Premium*** categories. This document has been named as "Supplementary Instructions for MES Schedule of Rates 2021", and will be issued separately as a booklet to all MES formations and users in hard and soft copy by the Directorate of Planning & Works.

These instructions contain the following contents: -

(1) Mix Designs for the compressive strengths of concrete ranging from 3000-6000 psi. In actual projects, MES Executives are to ensure that the contractor gets mix designed from DD&C or any other consultant to obtain the strength of concrete specified in the drawings. Mix designs provided in the Supplementary Instructions are only to be used as guidelines by the MES Executives.

(2) List of products/ brands included under ***Standard, Deluxe and Premium*** category.

(3) List of transformers included in ***Type A, Type Band Type*** **C** category.

**Summary of Section Wise Deletions, Modifications and Additions**

MES Schedule of Rates 2021 has in total thirty (30) sections. Though changes have been made in all Sections, but in some of the Sections many conceptual changes and new methods of constructions have been included. Therefore, some of the major changes in few selected Sections are described below.

*Section - 1: Excavation and Earth Work*

(1) Rates of excavation are now based on mechanical means instead of manual methods because this is the practice now. Due to this, excavation in ordinary and hard soil will be now paid in increment/ step of 3 M instead of previous increment of 1.5 M. This has resulted into significant reduction in the rates of excavation.

(2) Lead of building and road works have been separated. Increment of building work lead is 1 KM instead of previous 500 M, and increment of road work lead is 5 KM instead of previous 1 KM.

*Section- 2: Roads and Runways*

(1) Old name of this section was Roads, Hard Standings and Landing Grounds which has now been changed as Roads and Runways as construction of landing grounds is no more in practice.

(2) Rate of Pavement Quality Concrete (PQC) having flexural strength of 600 psi for runways and taxiways has been added.

(3) Plastic, rubber and metal speed breakers and studs has been added.

(4) Runway paint marking has been added.

(5) Sub grade of over burnt bricks has been deleted being obsolete.

(6) Cold surface dressing and premix carpet with cold emulsion has been deleted being not in use.

*Section - 3: Concrete*

(1) Classification of concrete as Regular/ Normal Concrete (Type A, Type B, Type C and Type D) and Special / Weigh-Batched (Plant Mix) Concrete is deleted.

(2) Concrete is now classified as Non-Structural Concrete (PCC 1:6:12, PCC1:4:8, PCC 1:3:6, PCC 1:2:4) and Structural Concrete having minimum 28 days' cylindrical strength ranging from 3000 - 6000 psi.

(3) Structural concrete is now specified in terms of 28 days' compressive strength instead as Type A, Type B, Type C etc.

(4) Structural Concrete is now to be based on mix designed by DD&C or any other consultant instead of past practice of volume and weight based mix proportions e.g., 1:2:4, and new schedule items and rates are described and derived accordingly.

(5) Approximate mix designs for concretes of compressive strengths ranging from 3000 to 6000 psi has been provided in "Supplementary Instructions for MES Schedule of Rates 2021" for the guidance of field executives.

*Section - 7: Doors and Windows*

(1) Tubular Particle Doors have been introduced being stronger and durable. These doors can be used in certain special works instead of hollow flush doors.

(2) Doors and partitions of Ash Wood and Mahogany have been included in addition to the ones made of Deodar.

(3) Aluminum doors and windows of Economy class have been omitted, and these are now categorized as of Deluxe and Premium quality. Further, same rate is given for any size, colour, texture and country of origin.

*Section - 10: Roof Covering and Roof Treatments*

(1) Asbestos Cement sheets and Black sheets have been deleted being obsolete.

(2) Newly introduced PVC sheets for roofing have been added.

*Section - 12: Flooring and Tiling*

(1) Tiles have been categorized as Standard, Deluxe and Premium based on sizes.

(2) Marble has been categorized as Standard, Deluxe and Premium. Each category contains different sizes and thickness.

(3) Granite has been categorized as Standard, Deluxe and Premium.

(4) Wooden floors have been deleted.

(5) Premium quality artificial wooden/ laminated and carpet tiles have been introduced.

*Section - 17: Sanitary Fittings*

(1) WHBs, WCs (European pattern), single lever basin mixers, basin mixers, sink mixers, wall showers, hand showers, double bib cock, 6 and 7 pieces bath sets have been categorized as Standard, Deluxe and Premium. List of products falling in these categories have been provided in "Supplementary Instruction for MES Schedule of Rates 2021".

(2) Wall hanging WC with concealed type flush tank added.

(3) Hydraulic seat cover added.

*Section - 18: Water Supply*

(1) Electromagnetic smart water meters have been added.

(2) Tube Ms Schedule 40, 20-150 mm diameter added being high pressure pipe arid durable.

(3) uPVC Pipes and allied fittings deleted being non-food grade items.

(4) Fiber Glass Water Tanks deleted being non-durable.

(5) Polyethylene (PE-100) PN 16 and PN 12.5 pipes/ fittings have been added

*Section - 24: Internal Electrifications*

(1) Fans and LED Lights have been categorized as Standard, Deluxe and Premium.

(2) Items Added: PVC channel putty with wiring, LED tube and panel lights, smart energy meter, PVC pipes, telephone and TV cables, gang switch series (imported), magnetic contactor 3-phase, MCCB and poles of different types.

(3) Items Deleted: Hard wood batten wiring, steel concealed conduit stove enameled wiring, pendant stiff, bracket exterior, swan neck, shade enameled items, fluorescent tube and chokes all type, switch fuse, IC, single and three phase, bus bar trunking, electric heater, tubular mechanical replacement indicator, fan electric, AC Imported (National, Toshiba, Sanyo, Fisher etc).

*Section - 25: External Electrifications*

(1) Items Added: Conical and Octagonal Poles 9, 10 and 12 M, H Type Lattice Steel Pole (45 feet), Cable Electric HT / LT - Single and 3 Core Aluminum / Copper, PVC Straight Joint for single core cable, Pad mounted Power Transformers, LT Panel without MCCB different range, PG Clamp, Bus Tie Ducts, Cable Tray, ATS Panel, LED Flood Security, LED Street Lights and Dry type transformer.

(2) Items Deleted: Taps line for 10 SWG, HL / LT Switch Gears - OCB panel, Road Light Accessories - Mercury and Sodium, RCC poles, 9.14 & 10.9 M long.

The responsibility for execution, s4pervision and implementation of the specifications and rates rests with the Engineer-in-Charge, however, all other stake holders also share the responsibility to adhere to the rules, procedures and specifications denoted herein.

Rawalpindi
31 May 2021

Brigadier
Director Research and Support
(Shahid Iqbal)

# ACKNOWLEDGEMENTS

This document includes very valuable contributions from Military Officers ex Corps of Engineers and MES Officers / staff. While deeply appreciating the efforts of these professionals, it is important to acknowledge the following officers/ staff who contributed in revision of MES Schedule of Rates 2021, with exemplary commitment and dedication:-

1. Major General Saeed Akhtar, HI (M)
2. Brigadier Dr. Shahid Iqbal
3. Brigadier Dr. Abdul Qudoos Khan
4. Brigadier Raza Noor Ali Khan
5. Chief Engineer Wasim Anwar
6. Chief Engineer Amad ud Din Sheikh
7. Chief Engineer Akmal Hussain (Retired)
8. SE Shakil Ahmad.
9. SE Shahid Hussain
10. SE Muhammad Khaliq uz Zaman Khan
11. SE Muhammad Ibrar Aslam
12. SE Abdur Rehman Janjua
13. SE Mumtaz Ali (Retired)
14. SE Zarin Gul (Retired)
15. CSO Muhammad Amin Saleemi (Retired)
16. XEN Iftikhar Ahmed
17. XEN Sanab Ud Din
18. XEN Dr. Muhammad Kashif
19. XEN Muhammad Aqib Khan
20. XEN Syed Shakeel Ahmed Jan
21. XEN Ali Wajahat
22. Major Muhammad Amjad
23. XEN Abdul Majeed (Retired)
24. A/XEN Muhammad Ejaz Khan
25. A/XEN Iftikhar Ahmed
26. A/XEN Humayun Pheroze
27. AE Jan Muhammad
28. AE Tahir Rashid Dar
29. AE Zafar Iqbal
30. AE Liaqat Ali
31. Sub Engr Muhammad Mubbashir
32. Sub Engr Shahid Hussain
33. Sub Engr Muhammad Alamgir
34. Supdt Shajar Abbas
35. Cptr Op Muhammad Muneer
36. UDC Muhammad Safdar
37. LDC Hamza Zafar

# CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| - | Preface | i |
| - | Executive Summary | iii |
| - | Acknowledgements | ix |
| - | Contents | xi |
| - | General Rules | xiii |
| - | Acronyms / Abbreviations | Xix |
| - | Conversion Tables | xxiii |
| 1 | Excavation and Earth Work | 1 |
| 2 | Roads and Runways | 11 |
| 3 | Concrete | 34 |
| 4 | Brick Masonry | 48 |
| 5 | Stone Masonry | 54 |
| 6 | Wood Work | 57 |
| 7 | Doors and Windows | 65 |
| 8 | Ancillary Items (Mongery) | 81 |
| 9 | Steel and Iron Work | 89 |
| 10 | Roof Coverings and Roof Treatments | 98 |
| 11 | Termite Treatment | 108 |
| 12 | Flooring and Tiling | 110 |
| 13 | Plastering | 119 |
| 14 | Ceilings and Paneling | 122 |
| 15 | Finishes (Distempering and Painting) | 125 |
| 16 | Glazing | 134 |
| 17 | Sanitary Fittings | 136 |
| 18 | Water Supply (Piping, Plumbing and Allied Works) | 142 |
| 19 | Water Supply Installations | 179 |
| 20 | Internal Sewerage | 189 |
| 21 | External Sewerage and Drainage | 199 |
| 22 | Pre - Engineered Construction | 208 |
| 23 | Demolition and Dismantling | 222 |
| 24 | Internal Electrification | 225 |
| 25 | External Electrification | 261 |
| 26 | Natural Gas | 322 |
| 27 | Electro-Mechanical Equipment | 335 |
| 28 | "Material Supply Only" Rates - Buildings, Roads, Runways etc | 382 |
| 29 | "Material Supply Only" Rates - Electrification, Water Supply, Natural Gas etc | 391 |
| 30 | Calculation Sheet for Cement | 403 |
| 31 | Labour Rates | 405 |
| - | Index | 406 |

## GENERAL RULES

1. **Generally.** Unless stated or specified elsewhere to the contrary, these General Rules shall apply to all sections, where relevant.

2. **Component Parts.** The component parts of this Schedule (Specifications, Method of Measurements, and Clarification of Rates etc.) shall be read together.

3. **Application.** This schedule is intended to apply to every description of work that may be required in the construction and maintenance of buildings of all kind belonging to, hired or occupied by the Government of Pakistan (Ministry of Defence) and also include fortifications, roads, runways, drainage, water supply, electrification, together with other engineering works such as sea walls, groynes, harbours, dock works, bridges and railways etc, required by various Maintenance or Special contracts.

4. **Specification** or **"as Specified"** refers to the specifications in this Schedule.

5. **Engineer-in-Charge.** The Officer nominated in the Contract by the Accepting Officer.

6. **Definitions**

   a. ***Alternative.*** Where alternative materials, processes etc, are specified, the selection will depend on local conditions and discretion of the Engineer in Charge.

   b. ***"Approved", "Directed", "Ordered"*** means the approval etc, of the Engineer in Charge unless otherwise stated.

   c. ***Carriage*** implies conveyance by any reasonable means over any negotiable surface and includes loading, unloading, etc.

   d. The ***Distance*** refers to the distance from the place of origin to the final position in the work, irrespective of the number of processes (or stages) involved.

   e. ***"Ditto"*** wherever used in this Schedule, includes the whole of the work described in detail in the preceding item, but with such modifications as may be specifically mentioned.

   f. ***Equal and Approved.*** Where specific materials, processes etc, are specified, the Engineer-in-Charge is at liberty to approve and accept suitable alternatives, should the original be not available. This discretion does not rest with the Contractor. Necessary adjustments in prices will be made under the appropriate sections of the Schedule.

   g. ***Identification of Items.*** Items shall be identified by quoting the Item number.

   h. ***"Materials and Labour"*** includes the supply of all materials, including lead for any distance, labour and workmanship necessary for complete execution of the item as described, together with use of all tools, plants, scaffolding and appliances that may be required.

   i. ***"Labour only or except materials"*** are to be understood as including the performance of all labour necessary for properly carrying out a particular service complete with the provision and use, without extra charge, of all tools, plants, scaffolding and appliances required.

   j. ***"Except bricks"*** include all necessary labour, plants etc, as described in the foregoing clause, and in addition, all material required except those specifically exempted.

   k. ***"Fixing", "Fixing only", "Laying only" and "Setting only"*** include the performance of all labour necessary for proper execution of the items as described, together with the provision and use, without extra charge, of all tools, plants, scaffolding and appliances required. In addition to the foregoing, they also include provision including lead for any distance, without extra charge of all materials subsidiary to and not supplied as part of the principal material, but necessary for execution of the work e.g. nails, screws, glue, packing pieces, joining, bedding materials and the like.

   l. [11]***Fixing only in Repairs"*** includes all labour and subsidiary material required in fixing and in addition, all necessary labour, plants, tools etc, that may be required for taking out the old materials and removing to store. Similarly, the expression ***"Add if in Repairs"*** includes taking down old material including plugs and hold fasts etc., making good and removing to store. These rates include obtaining access by raising covers to fittings etc. and replacing them, breaking' up large trusses etc into portable parts and where applicable, painting one coat of paint on new wood work of eased edges and such like.

   m. ***Orders.*** Orders in writing shall be given for all approved direction. No verbal instructions shall be deemed to be binding, nor shall such work be measured.

   n. The Term ***"Rates"*** used in this Schedule shall imply rates in this Schedule and / or contract rates based on this Schedule of Rates.

o. The term ***"Mindef Premises"*** used in this Schedule means any premises (whether owned by Govt of Pakistan or otherwise), on which work is carried out under the supervision of the MES.

p. ***"Store"*** used in connection with the supply of materials, or the disposal of old materials shall mean any MES store or place of deposit within the area of the Contract. In cases where outstations are included under a main Contract, the "Store" is to be understood as referring to the MES Store at those outstations, for all works so executed.

q. ***Tools, Plant and Machinery*** implies the use of all tools, plant and machinery required for execution of the work and all charges in connection.

r. ***Quality.*** The Materials except where specified otherwise shall be of the best quality indigenous make, ASTM / BS / PSS Nos whatever specified shall deem to be the latest version of the relevant Standard.

7. **Full Provision.** The Contract rates will include every allowance necessary, without extra measurement or charge, for any or all of the following matters.

a. ***Bad Work.*** Remedy and make good all defective or bad work to the satisfaction of the Engineer-in-Charge.

*b.* . ***Complete Work.*** Materials, labour, supervision, tools, plants, machinery, wages, insurance, overhead charges, profit, carriage, delivery, erection, laying, fixing, octroi charges, taxes, royalties, water charges etc.

c. ***Contract Document.*** Full compliance with all matters in the contract documents including Schedules, Specifications and Drawings etc.

d. ***Curved Work etc.*** Work of any quantity, size or shape whether level, inclined, straight, curved, battered etc.

e. ***Mindef Materials, Fittings and Fixing.***

(1) Load, remove from store, unload, unpack, assemble, prepare empty packages and return the same to stores.

(2) Any assumed loss of profit to the Contractor for stores, not supplied by him.

f. ***Difficult Position etc.*** Accessibility or otherwise of site, easy or difficult positions, foul, clean, wet or dry situations.

g. ***Dry Work etc.*** Keep work clear of all water, except from powerful springs and subsoil water, in which case extra payment shall be admissible for pumping out water by any means, if specially ordered by the Engineer-in-Charge.

h. ***Errors.*** Rectify all errors to the satisfaction of the Engineer-in-Charge (e.g. when excavations are carried out deeper than ordered or required, level shall be made up with Cement Concrete.

i. ***Handing Over.*** Hand over the work clean, perfect and ready for use or occupation upto general standard of all good works.

j. ***Maker's Instruction.*** Comply with maker's instructions etc, in connection with use of proprietary articles.

k. ***Measurements.*** Any contingencies involved in method of measurements (advantageous or disadvantageous) here in set forth.

l. ***Rubbish.*** Removal and disposal of rubbish.

(1) Off Mindef premises.

(2) Anywhere on Mindef premises including spreading, leveling, stacking etc, as required.

m. ***Temporary Work etc.*** Provision of temporary roads, cart ways, fencing, handrails, lighting, watching, also any gangways, profiles, templates, gauges, measures etc.

n. ***Waste etc.*** All waste, laps, scams, joints, cutting (rough or fair) straight, raking or circular and making good.

o. ***Workers.*** Provision of suitable skilled workers as required and all matters (accommodation, transport, health, sanitary services etc) in connection with the same.

## MEASUREMENTS

8. **Money Unit.** The money unit (or rate) of each item is expressed in Rupees.

9. **Net.** Measurements shall be "Net" as fixed, with no allowances for cutting, waste, laps for joints, risk etc. No allowance is to be made for large or small quantities, easy or difficult positions, or other exceptional circumstances except where specifically provided for in the Schedule.

10. **Inclusive Description.** The following principles apply to the whole Schedule.

a. Any description shall be assumed to comprehend any incidental processes.

b. No extra measurement or description shall be made for any matter already described elsewhere.

11. **Other Methods**

a. All works executed and paid for under this Schedule are to be measured in accordance with instructions and remarks detailed here in, without reference to any local custom or other practice, should that differ in any way from methods used in this Schedule.

b. Items, rates, description of materials and workmanship, modes of measurement etc, contained in all previous Schedules are to be considered as **obsolete.** They shall not constitute a precedent for purposes of comparison with (or interpretation of) the contents of this Schedule.

12. **Removal.** This expression includes handle, load, convey by any means, unload, stack, weigh, measure and in the case of Mindef store, unpack, assemble, prepare and return empties to store in addition.

13. **Removal Distance.**. This shall be measured by the shortest practicable route as approved.

14. **Tolerance**

a. Take dimension: to the nearest 25 mm (except as otherwise indicated in this Schedule) ignoring fraction under 15 mm.

b. Work out areas to the nearest $1110^{th}$ of a Sqm ignoring fractions under $11100^{th}$ of a Sqm.

c. Work out cubic contents to the nearest $1110^{th}$ of a Cum ignoring fractions under $11100^{th}$ of Cum.

## RATES

15. The **Rates** throughout this Schedule shall be deemed to include everything incidental to the complete work, to the satisfaction of the Engineer-in-Charge and include among other matters.

a. ***Generally.*** Full compliance with General Rules etc, where relevant, specially Rule 7, sub rules ua" to "o" inclusive.

b. ***Particularly.*** All relevant matters in the particular section in which an item and rate occur.

c. ***Additionally.*** Any relevant matter in any section.

d. ***Omissions.*** All matters generally necessary for complete performance and handing over of all works, in a clean serviceable condition, whether specially mentioned or not.

16. **General Applicability.** The inclusion of a rate in one section shall not preclude its applicability for a work covered in another section. The rate shall be applied, if it covers the nature of work and the later Section does not include rate for such work. The decision of E-in-C / DW&CE on the applicability of the rate shall be final and binding.

17. Subject to the over-riding provisions of the conditions of the Contract, **payment** for work not specifically mentioned herein shall be made as explicated in this Para.

a. **Proportional Rate.** If there are analogous items in the Schedule for articles or workmanship of similar character, then at prices equal to the prices of such items, if the articles or workmanship are of equivalent value, or, if differing in particulars and value, at prices determined by the applicable trade variations. The Schedule item on which a price is based is to be stated on the order.

b. **Star Price**

(1) If the articles or workmanship are so dissimilar as not to admit direct assessment or proportioning as laid down in Rule 17a above, then at the agreed price, which shall be in conformity with the general standard of values in the Schedule, and shall whenever possible, be based upon suitable schedule items.

(2) If in special cases, prices have necessarily to be determined from the amount of labour expended and the value of the materials incorporated, payment will be made as follows.

(a) Labour at chedule Rates given in ***"Labour Rate"*** (Section 31) to which the **Contract percentage** will be applied.

(b) Materials not included in the **"Material Supplied Only"** rates in Section 28 and Section 29, shall be paid at their actual market cost (net cost after deduction of all discounts), duly verified by the **Accepting Officer, CMES/GE,** with an addition of **25%** to cover all charges, taxes and profit.

(3) Prices shall be determined before the execution of work. If a price should depend upon particulars which can't be ascertained before the order is put in hand, the procedure by which actual price is to be arrived at when the particulars are known, shall be previously settled.

(4) Should **a Star Price** approved by the Competent Authority be inserted in an order, it will be understood that the Contractor accepts it, unless he objects in writing within six (6) days from the receipt of order.

(5) Star rates shall be strictly prepared in accordance with Para-397 of Defence Services Regulations for MES 1998. Following will be kept in mind while preparing/ fixing star rates:-

(a) A GE is authorized to fix star rates for any contract such that the payment involved does not exceed Rs. 15000. The cumulative effect of all star rates fixed by a GE shall not exceed 15 percent of the contract value.

(b) ACMES is authorized to fix star rates for all contracts such that the cumulative effect of all star rates shall not exceed 20 percent of contract value.

(c) In case of cumulative effect of star rates exceeds 20 percent of contract value, concurrence of Accepting Officer shall be essentially required before fixing of star rates.

(d) All star prices will be checked by CMES / AQS before approval. AQS shall be responsible for verification of market rates used as basis for preparation of star rates.

(e) Record of all rates at a station will be kept with CMES office. CMES will ensure that there is no variation in star rate of same item used in different works under his command.

(f) All CsMES will share details of all Star rates with E-in-C's Branch, DP&W on six monthly basis, DP&W will scrutinize all the rates and recommend frequently used items for inclusion in MES Schedule of Rate.

(6) In any case, star are not admissible for following:-

(a) Any specialized item/equipment that require designing and / or the design is required to be integrated into overall building design. Such matters will be referred to E-in-C's Branch, DD&C for advice.

(b) For any imported items / equipment, prior concurrence of Accepting Officer will be required in such case(s).

(7) Items based on star rates shall be included in Schedule 'F' of contract agreement.

(8) GE will render a certificate that articles or workmanship are so dissimilar as not to admit direct assessment or proportioning as laid down in MES Schedule of Rates.

c. Unless explicitly stated in the order or agreement to be "Net" (in which case it must be so shown when billed), all special prices, other than those assessed from actual cost under Para 17b.(2) above, shall .be subject to the Contract percentage, if any.

18. **Materials Supplied Only.**

a. The rates for ***"Materials Supplied Only"*** are the rates which have been used in computing the rates for various Schedule items. The ***"Materials Supplied Only"*** rates, inter alia include, lead for any distance upto the site of work and cost of containers only.

b. If the Contract provides issue of any of the materials listed under ***"Materials Supplied Only"*** *to* the Contractor on payment, the rates to be charged to the Contractor shall be the same as the *Materials Supplied Only Rates,* subject to following conditions.

(1) The delivery shall be made at the MES store(s) mentioned in the Contract and the Contractor shall, except where rates may otherwise specifically provide for removal in this Schedule (e.g "Remove from Store and Fix"), be deemed to have made due allowance in his contract price for loading /unloading, transport to site and unpacking the stores etc as may be necessary.

(2) The containers will become property of the Contractor and will not be taken back by the MES.

c. If the Contract provides for supply of any of the materials, listed in "Materials Supplied Only" (Section 28 and Section 29), the rates to be paid to the Contractor, shall be same as the Material Supplied Only rates (to which the Contractor's percentage will be applied).

19. **Old Materials.** No extra charge shall be allowed for handling, fixing etc, of old materials as compared with new.

20. **"Raise (Raising)"** includes any hoisting or lowering.

21. **Remove from Store,** shall include removal from store to site of work or, if directed, anywhere within a 4 Km radius.

22. **Remove off Mindef Premises,** shall include as an alternative a distance of 4 Km in case non Mindef or other premises.

23. **"Store"** in Rules 18, 21, and 22 implies.-

a. The Mindef or (MES) store referred to in the Contract,

b. The MES Store in the Contract Area, OR

c. Any other store or place not exceeding 4 Km from the site of work.

24. **Water.** The conditions under which water for the works may be obtained from MES supply system, shall form the subject of a separate agreement between the Engineer-in-Charge and the contractor, unless otherwise specified in the Contract.

25. **Deviation from Specifications and Rates.** The rates as specified are payable only if specifications given in this Schedule of Rates are adhered to in totality. However, where it is unavoidable to deviate from these specifications, prior approval of the competent Engineer Authority will be obtained and unless specified otherwise, corresponding financial adjustment in the rates shall be made for payment. In case of any dispute regarding applicability of any rate, ***the decision of Engineer-in-Chief shall be Final, Binding and Conclusive.***

## ACRONYMS / ABBREVIATIONS

| Acronym /Abbreviation | Description |
|---|---|
| A | Ampere |
| AASHTO | American Association of State Highways and Transportation Officials |
| AC, ac | Asphalt Cement, Alternating Current, Air conditioner, Air conditioning |
| ACB | Air Circuit Breaker |
| ACE | Additional Chief Engineer |
| ACSR | Aluminum Conductor Steel Reinforced |
| ACV | Aggregate Crushing Value |
| AFC | Automatic Frequency Control |
| Ah | Ampere hour |
| Approx, approx | Approximate, approximately |
| ASTM | American Society of Testing Materials |
| Auto, auto | Automatic, automatically |
| Avg,avg | Average |
| AVR | Automatic Voltage Regulator |
| AWG | American Wire Gauge |
| Barg | Bargauge |
| BBES | Bitumen Binding Enamel Surface |
| BC | Bayonet Cap |
| BG | Birmingham Gauge |
| Bit mac | Bituminous Premix Carpet |
| BQ | Bill or Bills of Quantities |
| BS | British Standards |
| BSS | British Standard Specifications |
| BTU | British Thermal Unit |
| OC | Degrees Celsius / Centigrade |
| CBR | California Bearing Ratio |
| CC | Cement Concrete |
| CG | Cord Grip |
| CGI | Corrugated Galvanized Iron |
| CI | Cast Iron |
| Cm,cm | Centimetre |
| CM | Cement Mortar |
| CMA | Cable Manufactures Association, Controller of Military Accounts |
| CMES | Commander Military Engineer Services |
| CNos | Hundred Numbers |
| CP | Chromium Plated, Chrome Plated |
| CSW | Clerestory Window |
| CT | Current Transformer |
| Cu | Cubic |
| Cusec, cusec | Ft3 / sec |
| Cu Cm, cc, $cm^3$ | Cubic Centimetre |
| Cum, cum | Cubic Metre |
| DC | Direct Current |
| Dia, dia | Diameter |
| DP | Double Pole |
| DPC | Damp Proof Course |
| Drg, dwg | Drawing |

| Acronym /Abbreviation | Description |
|---|---|
| DST | Double Surface Treatment |
| DW&CE | Director Works & Chief Engineer |
| EHT | Extra High Tension |
| EHV | Extra High Voltage |
| E-in-C | Engineer-in-Chief |
| ES | Edison Screw Cap |
| ET | Electrical Thread |
| Exe, exc | Exceeding, exceed |
| Exel, excl | Excluding, excluded |
| OF | Degrees Fahrenheit |
| FC | Fibre Cement |
| FI | Flakiness Index |
| FRP | Fibre Reinforced Pipe |
| Ft, ft | Foot, Feet |
| Gal, gal | gallon |
| Galvd | Galvanized |
| GE | Garrison Engineer |
| GF | Ground Floor |
| GI | Galvanized Iron |
| GL | Ground Level |
| gm | Gram |
| Govt | Government |
| gpd | Gallons per Day |
| GPM, gpm | Gallons per Minute |
| HC | High Conductivity |
| HD | Hard Drawn |
| HOPE | High Density Poly Ethylene |
| HP, hp | Horse Power |
| Hr, hr | Hour |
| HRC | High Rupturing Capacity |
| HS | Heat Shrink |
| HT | High Tension |
| HV | High Voltage |
| IC | Iron Clad |
| In, in | Inch |
| lncl, incl | Including, includes, included |
| J | Joule |
| JMF | Job Mix Formula |
| K | Kilo ($10^3$), Kip |
| KA | Kilo Ampere |
| Kg, kg | Kilogram |
| Km,km | Kilometre |
| Kmph | Kilometre per hour |
| KVA | Kilo Volt Ampere |
| Kw | Kilo watt |
| KWh, kwh | Kilo Watt hour |
| I, lit | Litre |
| Lb, lb | Pound |
| LL | Liquid Limit |

| Acronym /Abbreviation | Description |
|---|---|
| LT | Low Tension |
| LV | Low Voltage |
| M,m | Meter |
| Max, max | Maximum |
| MC | Medium Cutback |
| MCB | Molded Circuit Breaker |
| MCCB | Molded Case Circuit Breaker |
| MOD | Maximum Dry Density |
| MDF | Medium Density Fibre |
| MDI | Maximum Demand Indicator |
| MES | Military Engineer Services |
| Mfd | Milli Faraday |
| Mg, mg | Milligram |
| Min, min | Minute (time), minimum |
| Mindef | Ministry of Defence |
| M Nos | Thousand Numbers |
| Mm,mm | Millimetre |
| MS | Mild Steel |
| mva | Milli Volt Ampere |
| N | Newton |
| Notexc,notexc, n.exc | Not exceeding, not exceed |
| OCB | Oil Circuit Breaker |
| n | Ohm |
| Pa | Pascal (unit of stress) |
| PCC | Plain Cement Concrete |
| PCSIR | Pakistan Council on Scientific Research |
| PE | Poly Ethylene |
| PF | Power Factor |
| PI | Plasticity Index |
| PILC | Paper Insulated and Lead Cover |
| PM | Phase Modulator |
| POL | Petrol, Oil and Lubricants |
| PPD, ppd | Pounds per Day |
| PPGI | Pre painted Galvanized Iron |
| ppm | Parts per million |
| PPR | Poly propylene Random |
| PSS | Pakistan Standard Specifications |
| PT | Potential Transformer |
| PVC | Poly Vinyl Chloride |
| RC | Rapid Cutback |
| RCC | Reinforced Cement Concrete |
| RM | Running Metre |
| RPM, rpm | Revolutions per minute |
| SC | Slow Cutback |
| S Eq | Sand Equivalent |
| SP | Single Pole, Single Phase |
| Sq,sq | Square |
| Sqm, sqm | Square Metre |
| Sq Cm, sqcm | Square Centimetre |

| Acronym /Abbreviation | Description |
|---|---|
| STA | Steel Tape Armoured |
| SW | Steel Wire |
| SWA | Steel Wire Armoured |
| SWG | Standard Wire Gauge |
| SWV | Soil, Waste and Ventilation |
| Sym | Symmetrical |
| T | Metric ton |
| TOU | Time of Utilization |
| T&P | Tools and Plants |
| TP | Triple Pole |
| TPN | Triple Pole and Neutral |
| TST | Triple Surface Treatment |
| uPVC | Un-Plasticized Poly Vinyl Chloride |
| V | Volt |
| Vent | Ventilation |
| VCB | Vacuum Circuit Breaker |
| W | Watt |
| WBM | Water Bound Macadam |
| we | Water Closet |
| We | Water Column |
| WI | Wrought Iron |
| X | Ten |
| XPM | Expended Metal |
| XLPE | Cross Linked Poly Ethylene |
| Yd, yd | Yard |

# CONVERSION TABLE

| Convert from (A) to (B) i.e. (B) = (C) **x (A)** | | **Multiplication Factor** {C) |
|---|---|---|
| (A) | (B) | |
| ***Length*** | | |
| in | cm.mm | 2.540 cm, 25.40 mm |
| mm | in | 0.0394 |
| **M,m** | ft | 3.2810 |
| ft | M,m | 0.3048 |
| yd | M,m | 0.9144 |
| Mile | km | 1.6090 |
| Nautical mile | km | 1.8530 |
| ***Area*** | | |
| sqin | sqcm | 6.4516 |
| sq ft | sqm | 0.0929 |
| sq yd | sq m | 0.8361 |
| sq mile | sq km | 2.5900 |
| acre | sqm | 4046.9 |
| acre | hectare | 0.4047 |
| ***Volume*** | | |
| CU in | cu cm, cc, $cm^3$ | 16.3900 |
| cum | CU **ft** | 35.3100 |
| CU **ft** | $in^3$ | 1728 |
| CU ft | cum | 0.0283 |
| CU yd | CU m | 0.7646 |
| US gal | CU ft | 7.4820 |
| British gal | CU ft | 6.2400 |
| US gal | Litre, lit | 3.7850 |
| British gal | Litre, lit | 4.5460 |
| CU m | lit | 0.001 |
| gpm | cusec | **2.228 X** $10^{-3}$ |
| cusec | gpm | 448.83 |
| acre ft | CU **ft** | 43560 |
| ***Density I Unit Weight*** | | |
| $kN / m^3$ | $lb/ ft^3$ | 6.3660 |
| $lb/ ft^3$ | $kN / m^3$ | 0.1571 |
| $kN / m^3$ | $M Ton /m^3$ | 0.1020 |
| $M Ton /m^3$ | $kN / m^3$ | 9.8070 |
| $Ton/ m^3$ | $lb/ ft^3$ | 62.4300 |
| ***Weight/ Force*** | | |
| lb | kg | 0.4536 |
| kg | N | 9.8070 |
| lb | N | 4.4480 |
| kip or K | lb | 1000 |
| kN | kip or k | 0.2248 |
| Cwt | kg | 50.80 |
| T (British) | Tonne, M ton | 1.0160 |
| T (British) | lb | 2240 |
| Tonne | kg | 1000 |
| ***Pressure*** | | |
| atmosphere | K Pa | 101.30 ' |
| atmosphere | $lb/ ft^2$, psf | 2117 |
| atmosphere | lb/ $in\_^2$, psi | 14.70 |
| barg | KPa | 100 |
| $kg/ cm^2$ | K Pa | 98.07 |
| $kg/ cm^2$ | lb / ft2, psf | 2048 |

| Convert from (A) to (B) i.e. (B) = (C) **x (A)** | | **Multiplication Factor** (C) |
|---|---|---|
| (A) | (B) | |
| lb/ ft$^2$, psf | KPa | 20.89 |
| lb/ in$^2$, psi | KPa | 0.1450 |
| lb/ ft$^2$ | KPa | 0.04787 |
| lb/ ft$^2$ | lb/ in$^2$, psi | 144 |
| MPa | lb/ in$^2$, psi | 145 |
| ***Energy I Power*** | | |
| 1° F | 1° C | 0.555 ( ° F-32 ) |
| J | ftlb | 0.7373 |
| Nm | J | 1 |
| Watt hr | J | 3600 |
| Watt hr | BTU | 3.4120 |
| 1 Ton TNT | J | **4.184 x 10$^9$** |
| BTU/ hr | K Cal /hr , KW hr | 0.2930 |
| 1 T (air conditioning) | BTU | 12000 |
| hp | KW, (Watt) | 0.7457, (746) |
| ft lb/ min (ft lb /sec) | hp | 33,000, (550) |

**PREFIXES • FOR METRIC UNITS**

| | | | | |
|---|---|---|---|---|
| n | Nano, (10 •$^9$) | | C | Centi, (10 $^2$) |
| µ | Micro, (10 •$^6$) | | K | Kilo, (10 $^3$) |
| m | Milli, (10 $^{-3}$) | | M | Mega, (10 $^6$) |
| | | | G | Giga, (10$^9$) |

SECTION-1

# EXCAVATION AND EARTH WORK

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION -1
# EXCAVATION AND EARTH WORK

## SPECIFICATIONS

**1.0.0.** Excavation and Earth Work, pertaining to buildings and roads is covered under two separate sub-heads, since the requirements in both cases are different.

## SUB SECTION 1-1

## BUILDINGS

**1.1.1. Excavation.** Work under this section consists of excavation in all types of soil, lifting, transportation, disposal of excavated material within ten metre (10 M) for shafts, wells and independent holes upto 30 sqm and fifty metres (50M) for over area, back filling and fill for building foundations and under floor etc. Lead beyond these limits of 10 and 50 metres respectively will be paid separately. The Soil investigation report / bearing capacity of soil is the key indicator to judge the properties of soils/rocks.

## MATERIAL REQUIREMENTS

**1.1.2. Borrow Pits.** These are to be made only in areas and of the size and shape, approved by the Engineer-in-Charge.

**1.1.3. Classification of Excavation.** For the purpose of this section, excavations shall be classified and priced under the heads given in Table 1-1. Table also provides appropriate method of excavation.

**TABLE 1-1**

| Ser | Material Type | Excavation Required |
|---|---|---|
| (1) | **Ordinary Soil.** Very soft to firm clays, very loose to medium dense sands, soil or rubbish of every description, rubbish tip material, loose/medium stiff clay, silt, sand, gravel and loam. | Hand tools |
| (2) | **Hard Soil.** Very stiff to hard clays, dense to very dense sands, very low to low strength rocks, murram, kankar, mud concrete, conglomerate formations, shale, lime concrete, brick work / stone masonry in lime, mettalled surface of roads, bottoming, hard core under floor. | Power tools |
| (3) | **Rock not Requiring Blasting.** Medium to high strength rocks, CC, premix carpet, brick work and stone masonry in CM, large boulders that cannot be individually lifted by hand, soft rock or any other formation which can be excavated by jumpers, wedges, hammers etc. | Easy ripping |
| (4) | **Rock Requiring Blasting.** Very high to extremely high strength rocks which cannot be excavated by jumpers, wedges, hammers and power tools. | Blasting |

**1.1.4. Excavatibility.** It depends on the method used as well as the material properties. The strength of the material is one of the key indicator in assessing the excavation requirement. The blasting term as used here refers to the difficulty level and can include rock breakers, or expanding grouts.

**1.1.5. Mechanical Excavation for Rocks.** Excavatibility in terms of the type of mechanical machinery is based on ease of excavation. Tables 1-2 and 1-3 show requirement of mechanical excavators for rocks based on their ease of excavation.

**1.1.6.** The classification of excavation will be pre-determined by means of appropriate number of bore holes to the depths, required at the site. The approximate quantities for different classification, based on the above bore- hole results, will be kept "Provisional" in the Work Orders, Requisitions and Bill of Quantities etc.

**1.1.7.** In case, hard soil or rock is encountered, during excavation of soils or rock is visible and has to be excavated, prior written approval of the Engineer-in-Charge will be obtained, before commencing excavation or blasting etc. The actual quantities and classification of rock will be determined and recorded by the Engineer-in-Charge.

**1.1.8.** In case of disagreement, the case will be referred to the next higher authority, whose decision will be final, conclusive and binding. Measurement and classification will be agreed in writing, by both the parties, before any foundation / construction work starts.

**1.1.9.** Where blasting has been prohibited by the Engineer-in-Charge, excavation shall be carried out by pneumatic concrete breakers, ripper of dozer, sledge-hammers and heavy points or similar methods.

**TABLE 1-2**

| Ser | Ease of Excavation | Index Rating | Typical Machine that can be Used | Example |
|---|---|---|---|---|
| (1) | Very Easy | <40 | Hydraulic backhoe < 3 $m^3$ | CAT 235D |
| (2) | Easy | 40-50 | Hydraulic shovel or backhoe < 3 $m^3$ | CAT 235FS, 235 ME |
| (3) | Moderate | 50-60 | Hydraulic shovel or backhoe > 3 $m^3$ | CAT 245FS, 245 ME |
| (4) | Difficult | 60-70 | Hydraulic shovel or backhoe > 3 $m^3$; short boom of a backhoe | CAT 245, O&K RH 40 |
| (5) | Very difficult | 70-95 | Hydraulic shovelor backhoe> 4 $m^3$ | Hitachi EX 100 |

To calculate **Index Rating,** the following table may be used:-

**TABLE 1-3**

| Ser | Parameter | Index Rating | | | | |
|---|---|---|---|---|---|---|
| | | Complete | High | Moderate | Slight | Fresh |
| (1) | Weathering | 0 | 5 | 15 | 20 | 25 |
| (2) | Strength (MPa): UCS (50) | <20 | 20-50 | 40-60 | 60-100 | >100 |
| | | 0 | 5 | 15 | 20 | 25 |
| (3) | Joint spacing (m) | <0.3 | 0.3-0.6 | 0.6-1.5 | 1.5-2 | >2 |
| | | 5 | 15 | 30 | 45 | 50 |
| (4) | Bedding spacing (m) | <0.1 | 0.1-0.3 | 0.3-0.6 | 0.6-1.5 | >1.5 |
| | | 0 | 5 | 10 | 20 | 30 |

**1.1.10. Materials from Excavation.** Materials of any kind obtained from excavation, any finds made on the site, such as antiques, relics, coins, fossils, etc., shall remain the property of the Govt of Pakistan. The rates include separation of above mentioned materials from each other and depositing, as directed by the Engineer-in-Charge. Any of these materials, if ordered by the Engineer-in-Charge, to be used by the contractor on the works, shall be charged to him at the "Materials Supplied Only" rates given in this Schedule, subject to Contractor's percentage, or if, these are not available from the Schedule, then, rates to be mutually agreed between the Engineer-in-Charge and the contractor, before the materials are used.

## CONSTRUCTION REQUIREMENTS

### 1.1.11. Measures

1.1.11.1. **Solid Measure.** Materials in their natural state before excavation etc.

1.1.11.2. **Packed Measure.** Materials, which have been spread, leveled and /or filled, watered and compacted /rammed or equally consolidated (e.g. heaps, consolidated by exposure to weather etc. for a period exceeding 6 months).

1.1.11.3. **Loose Measure.** As packed measure, but not compacted /rammed or equally consolidated.

1.1.11.4. **Conversion Factors.** Table 1-4 shows the multiplying factors to convert in-situ measure into solid measure:-

**TABLE 1-4**

| In situ Measure | Multiplication Factors | | Remarks |
|---|---|---|---|
| | Soils | Rocks | |
| Loose Measure | 0.80 | 0.60 | These figures accurate or otherwise, shall be binding on all parties. |
| Packed Measure | 0.89 | 0.67 | |
| Solid Measure | 1.00 | 1.00 | |
| 90-100 % Modified AASHTO | 1.10 | Nil | |

**Notes:-**

(1) Un-suitable soil and any vegetation matter shall be separated from other soils excavated, if so directed.
(2) Undergrowth, brushwood and trees shall not be cut without the prior approval of the Engineer-in-Charge

### .1.1.12. Compaction

1.1.12.1. Where building / structural foundations are to be laid, shall have compaction of minimum 100% of Maximum Dry Density (MOD) of Modified AASHTO achieved in the laboratory for the cohesion-less soil and 95°/o of MOD for cohesive soil. This criterion is strictly followed. Where foundation crust becomes disturbed during excavation of footing, compaction of soil where required, be decided by the Engineer-in-Charge.

1.1.12.2. Compaction of soil under floor and plinth protection shall be 90 % of MOD of Modified AASHTO.

1.1.12:3. Soil under footpath should be well compacted with suitable means of compaction i.e. plate compactor,. mini rollers etc., to achieve minimum 90% of MOD.

1.1.12.4 Level of compaction in various situations/ conditions is given in Table 1-5 below:-

**TABLE 1-5**

| Class | Application | Compaction Level |
|---|---|---|
| I | Upper 0.5M of subgrade under buildings | **Extremely high** (100% of MOD) |
| II | Upper 1M of subgrade under rail tracks | **Very high** (98% of MOD) |
| | Upper 3M of fills supporting 1 or 2 story buildings | |
| 111 | Deeper parts of fills under buildings | **High** (95% of MOD) |
| | Lining for canal or small reservoir | |
| | Earthen dams | |
| | Lining for landfills | |
| IV | All other fills requiring some degree of strength or incompressibility | **Normal** (90% of MOD) |
| | Backfill in pipe or utility trenches | |
| | Drainage blanket or filter (Gravels only) | |
| V | Capping layers (not part of pavements)<br>Immediately behind retaining walls (self-compacting material "Drainage Gravel" etc.) | **Nominal** |

### 1.1.13. Survey and Setting Out Profiles etc.

1.1.13.1. All excavations, embankments, revetments etc., are to be properly set out to the true line curve, level or slopes required and the rates include the cost of all profiles, crossheads, boning rods etc., as well as tools and plants.

1.1.13.2. The Contractor shall provide Level, Theodolite or Total Station to carry out original ground survey, layouts and cross-sections etc., which will become the basis of measurement for various activities.

1.1.13.3. All survey record, prepared by the Contractor, shall be certified by the Engineer-in-Charge, before starting physical activities on ground. The contractor shall however, be responsible for any errors and omissions, in surveying record.

## METHOD OF MEASUREMENTS

### 1.1.14. Authorized Quantities

1.1.14.1 Authorized quantities and not those actually excavated will be paid for. Following are the authorized quantities:-

(1) The dimensions of foundations (lengths, widths and depths etc.), as shown on drawings.

(2) The lengths and widths of concrete beds under drains as shown on drawings and the depth from ground level (GL).

(3) For excavation of trenches for pipes:-

(a) The necessary length of trenches for pipes, etc.

(b) The width for excavation of trenches for pipes etc. shall be the external dia of the pipes (Not Socket), plus 225 mm on either side (225 mm+ External dia of pipe etc. + 225 mm). For depth exceeding 1.5 M, slope allowance of 125mm / metre (M) (in depth for each side of the trench) shall be made in addition to width, specified for full depth of the trench.

(c) The depth from ground level (GL).

(4) Excavation for Electric cables described in Section - 25 (External Electrification)

### 1.1.15. Measurements for Excavation and Earth Work

(1) The measurements to be those of the voids from which the material has been taken out and not of the resultant spoil. Where this is impracticable, the measurement shall be converted to "Solid measure" in accordance with Table 1-4. No allowance is made for slips or falls.

(2) Any pipes, cables etc. met with and damaged during excavation, would be repaired / replaced as directed by Engineer-in-Charge without extra cost.

(3) Excavations be restricted to the minimum dimensions necessary, and payment be made on the basis of net requirements.

(4) In excavations through varying strata, the different layers are to be paid for at the rate for the respective formations.

**1.1.16. Earth Filling under Floors/ Areas.** The height be based on average lift from the average ground level (GL). The depth of borrow pit will not be included in calculating the lift.

**1.1.17. Site Clearance, Roots, Trees etc.** No extra measurements or allowance shall be made for clearing the site of grass, shrubs, brushwood, undergrowth, roots and small trees not exceeding 225 mm girth at 60 cm from the ground. The realized material, except trees exceeding 225 mm girth, shall become the property of contractor, if not otherwise specified elsewhere in the Contract. Trees exceeding 225 mm girth shall be cut and disposed of by the concerned / other agency.

**1.1.18.** No extra measurement or allowance will be made for work intercepted by roots.

**1.1.19. Battering.** Battering (or contents thereof) shall not be measured, when timbering is ordered and battering is carried out to save timbering.

**1.1.20. Transportation of Spoils and Materials**

1.1.20.1. The following shall be considered equal to 1 Cum of spoil under the rates for "soils":-

(1) 1000 Liters of water.
(2) 2.5 Cum of scantling, boarding etc.
(3) 2.0 Cum of ashes, clinker, etc.
(4) 1.8 Ton of any material not elsewhere listed.

1.1.20.2. Individual articles which weigh over 200 Kg each shall be paid for an extra of 10% over "rocks".

1.1.20.3. The Lead for transportation of spoils and materials must be supported with documentary evidence and necessary Google map clearly depicting Pick and Drop stations be attached.

**1.1.21. Measurements not to be done.** Ignore following:-

(1) Steps inside excavation to form platform etc., for raising earth.
(2) Any slips or falls.

## CLARIFICATION OF RATES

**1.1.22.** The rates, inter alia, include particularly:-

(1) Any slips or falls (to be made good).
(2) Works in excess of requirements and for making good to same as required.
(3) Cleaning out sludge.
(4) Filling soft spots as required.
(5) Solid measures or conversion into solid measure.
(6) Landing grounds, buildings etc. of any description.
(7) Any other relevant matters related to excavation and earthwork, stated elsewhere.
(8) For excavation in foundation, trenches / areas, forming sides and bottom surfaces to required shape, level and slope, and compacting /ramming in case of ordinary and hard soils.

## SUB SECTION 1-2

## ROADS

**1.2.1. Classification of Soil.** For the purpose of this sub-section, soil shall be classified as per Table 1-6

**TABLE 1-6**

| AASHTO Soil Classification System | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **General Classification** | **Granular Materials 35% or less passing 200 Sieve (0.075 mm)** | | | | | | | **Silt-Clay Materials > 35% passing 200 Sieve (0.075 mm)** | | | |
| **Group Classification** | **A-1** | | **A-3** | **A-2** | | | | **A-4** | **A-5** | **A-6** | **A-7** |
| | **A-1-a** | **A-1-b** | | **A-2-4** | **A-2-5** | **A-2-6** | **A-2-7** | | | | **A-7-5 A-7-6** |
| **Sieve Analysis, % passing** | | | | | | | | | | | |
| 2.00 mm (No. 10) | 50 max | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0.425 mm (No. 40) | 30 max | 50 max | 51 max | --- | --- | --- | --- | --- | --- | --- | --- |
| 0.075 mm (No. 200) | 15 max | 25max | 10 max | 35 max | 35max | 35max | 35max | 36min | 36 min | 36min | 36min |
| **Characteristics of fraction Passing 0.425 mm (No. 40)** | | | | | | | | | | | |
| Liquid Limit (LL) | --- | | --- | 40 max | 41 min | 40max | 41 min | 40max | 41 min | 40max | 41 min |
| Plasticity Index (PI) | 6max | | **N.P.** | 10 max | 10max | 11 min | 11 min | 10 max | 10max | 11 min | 11 min$ |
| Usual types of significant constituent materials | Stone fragments, gravel and sand | | Fine sand | Silty or clayey gravel and sand | | | | Silty soils | | Clayey soils | |
| General Rating as a sub-grade | Excellent to Good | | | | | | | Fair to Poor | | | |
| PI of A-7-5 subgroup is equal to or less than LL - 30. PI of A-7-6 subgroup is greater than LL - 30 | | | | | | | | | | | |

**1.2.2. Survey and Setting Out Profiles etc.** It shall be carried out as per Para 1.1.13.

**1.2.3. Clearing and Grubbing.** It shall consist of:-

(1) Removal upto 30 cm depth of stumps, roots, bushes, and trees with less than 225 mm girth, vegetation and other objectionable material and disposal of all surface objects as and where directed by the Engineer-in-Charge.

(2) Operation of clearing and grubbing shall in no way be deemed to effect any level or volume change of the area.

**1.2.4. Removal of Trees.** It shall be carried out as per Para 1.1.17 and Para 1.1.18.

**1.2.5. Stripping**

1.2.5.1. The areas, from which stripping of topsoil is required, shall be as indicated on the drawings or as directed by Engineer-in-Charge.

1.2.5.2. The Contractor shall remove topsoil from these areas to depth as directed by the Engineer-in-Charge. Stripping of topsoil in any case shall not be less than 10 cm in depth.

1.2.5.3. The removed topsoil shall be deposited / spread at a location within Five (5) Km as directed by the Engineer-in-Charge.

1.2.5.4. Engineer-in-Charge shall identify the soil as unsuitable, through laboratory tests (if required) before ordering for start of stripping activity.

1.2.5.5. This item shall be paid as per the relevant item of the Schedule at the location, approved for such purpose.

**1.2.6. Compaction of Natural Ground.** Upto a depth of twenty (20) cm below the natural ground, all solids and vegetation shall be removed and clear surface shall be broken up by ploughing and scarifying. The natural ground will be compacted upto a depth of 20 cm to a degree as defined in Table 1-7 :-

**TABLE 1-7**

**Compaction of Natural Ground**

| S.No. | When Height of Embankment above Natural GL (cm) | Percent of MOD (As determined by MSHTO T-180) |
|---|---|---|
| (1) | 0 to 30 | 95 |
| (2) | 30 to 75 | 93 |
| (3) | Over 75 | 90 |
| (4) | Below the foundation of structures for Roads | 95 |

**Note:** - This item shall be paid as per the relevant item of Schedule at the location, approved for such purpose by the Engineer-in-Charge.

**1.2.7. Embankment.** The height shall be based on average lift from average ground level (GL). The depth of borrow pit is not included in calculating the lift. It comprise formation of the roadbed/ Improved subgrade with material suitable for embankment to which better quality of material is blended in proper proportion to improve its strength properties and performance.

## MATERIAL REQUIREMENTS

**1.2.8.** Material for embankment shall consist of suitable material, excavated from borrow pit, roadway excavation or structural excavation and shall include lead up to Five (5) Km and lift (where applicable). Borrow material will be used only when material obtained from roadway or structural excavation is not suitable or is deficient for embankment formation. The material under this item shall conform to following specification:-

(1) Contractor shall use AASHTO Class A-1, A-2, A-3, A-4 or A-5 soil as specified in Table 1-2-1, or other material, approved by the Engineer-in-Charge.

(2) CSR of the material shall not be less than five percent (5%), determined in accordance with AASHTO T-193. CSR value shall be obtained at a density corresponding to the degree of compaction, required for the corresponding layer.

(3) Swell Value of the material for embankment formation shall not exceed half percent (0.5 %). However, while establishing the swell value, surcharge weights representing the overburden will be used. In case sandy material is used for embankment formation, it shall be properly confined with cohesive material to the extent, as approved by the Engineer-in-Charge but with no extra payment. Sandy material shall not be used on slopes of embankment.

(4) The major component of improved subgrade shall consist of blending material of any soil having classification as A-1(a), A-1(b), A-2- 4 or A-3 according to AASHTO M 145 with PI of not more than six (6). The blended mixture when compacted to ninety-five percent (95%) of the maximum dry density determined by AASHTO T 180 (Method D), shall exhibit a laboratory soaked CSR (96 hours) of not less than twenty (20), or as specified in the Drawings.

(5) In areas subject to flood and prolonged inundation of the embankment, such as bridge sites, the material used in embankment, unless rock, shall be AASHTO Class A-1-a, A-1-b and A-2-4 soils. Other soils may be used only with the written consent of the Engineer-in-Charge.

(6) The proportion of each material to be incorporated for improved subgrade shall be established. The Engineer-in-Charge shall specify the single percentage of each material to be blended and establish the gradation of the resulting mixture alongwith the range of permissible gradation tolerances to obtain the required CSR for the improved subgrade. The blend proportions thus established shall apply only when each material to be used is obtained from same source. In case of a change in source of material, then a new proportion shall be established.

## CONSTRUCTION REQUIREMENTS

**1.2.9. Formation of Embankment from Borrow Excavation.** Material for embankment, obtained and approved as provided in Para 1.2.8, shall be placed in horizontal layers of uniform thickness and in conformity with the lines, grades, sections and dimensions shown on drawings or as directed by the Engineer-in-Charge.

1.2.9.1. The layers of loose material, other than rock shall not be more than 20cm thick, unless otherwise allowed by the Engineer-in-Charge after a trial section is prepared and approved.

1.2.9.2. The material placed in layers and scarified to the designated depth for formation of embankment. Embankment shall be compacted to the density specified in Table 1-8.

**TABLE 1-8**
**Compaction of Embankment in Layers**

| S.No. | When Depth of the Embankment Layer below Sub grade (cm) | Percent of MDD (As determined by AASHTO T-180) |
|---|---|---|
| (1) | 0 to 30 | 95 |
| (2) | 30 to 75 | 93 |
| (3) | Over 75 | 90 |

1.2.9.3. Improved sub-grade may be constructed with any combination of machines or equipment that will yield results meeting these specifications mentioned in Table 1-8:-

(1) **Stationary Plant Method.** The soil ingredients and water shall be mixed in an approved mixing plant (Pugmill). The plant shall be equipped with feeding and metering devices that will add the materials to be blended in the specified quantities. Water shall be added during the mixing operation in the quantity required for proper compaction, which is approximately optimum moisture content plus or minus 2%. The mixing time shall be that, which is required to secure a uniform mixture. After mixing, the blended material shall be transported to the job site while it contains the

sufficient moisture and shall be placed on the road bed by means of an approved mechanical spreader. The mixture shall be spread at rate that will produce a uniform compacted thickness conforming to the required grade and cross-section. Compaction shall start as specified to achieve relative compaction specified in Table 1-8.

(2) **Road Mix Method.** The materials shall be transported to the site and spread in layers on the road bed in the quantities required to produce the specified blend. After the materials for each lift have been spread, the materials shall be mixed by motor graders and other approved equipment until the mixture is uniform throughout. During mixing operation, water shall be added as necessary to bring the moisture content to the proper percentage.

(3) **Trial Sections.** Prior to the formation of the improved subgrade, the Contractor shall construct three trial sections of two hundred (200) m length one (1) for each blend of improved material proposed to be incorporated for improved subgrade, or as directed by the Engineer-in-Charge. The compacting equipment to be used in the trial sections shall be the same equipment that will be used for main work. The object of these trials is to determine the proper moisture content, the relationship between the number of passes of compacting equipment, density obtained for the blended material and to establish the optimum lift thickness that can be effectively compacted with the equipment used. No separate payment will be made for this work, which will be regarded as a subsidiary obligation of the Contract.

(4) **Protection of Completed Work.** Any part of the completed improved subgrade shall be protected, well drained and any damage shall be repaired as directed by the Engineer-in-Charge without additional payment. The Contractor shall be responsible for all the consequences of traffic being admitted to the improved subgrade. He shall repair any ruts or ridges occasioned by his own traffic or that of others by reshaping and compacting with rollers of the size and type necessary for such repair. He shall limit the improved subgrade preparation to an area easily maintained with the equipment available. Subgrade preparation and placement of succeeding layer to follow each other closely. The improved subgrade, when prepared too soon in relation to the placing of the layer above it, is liable to deteriorate and in such case the Contractor shall, without additional payment, repair, reroll, or re-compact the improved subgrade as may be necessary to restore it to the state specified herein.

(5) **Templates and straightedges.** The Contractor shall provide templates and straightedges in sufficient numbers to check the accuracy of the work and no work shall be permitted until the improved subgrade level have been checked and approved by Engineer-in-charge.

### 1.2.10. Formation of Embankment on Steep Slopes

1.2.10.1. Where embankments are to be constructed on steep slopes, hill sides or where new fill is to be placed and compacted against existing pavement or where embankment is to be built along one half the width at a time, the original slope of the hill side of existing pavement or adjacent to half width of embankment, shall be cut in steps of 20 cm depth.

1.2.10.2. Benching shall be of sufficient width to permit operation of equipment possible during placing and compaction of material.

1.2.10.3. Cut waste without rock vegetation and other unsuitable material shall be incorporated with the new embankment material and compacted in horizontal layers. No extra payment will be allowed for such an operation.

### 1.2.11. Formation of Embankment on Existing Roads

1.2.11.1. Before fill is placed and compacted on an existing roadway, the existing embankment and /or pavement may be leveled by cutting, rooting or scarifying by approved mechanical means to a level, to be determined by the Engineer-in-Charge.

1.2.11.2. The earth, old asphalt or other material, arising as a result of this operation will be declared either suitable or unsuitable by the Engineer-in-Charge, for use in embankment or any other item.

1.2.11.3. The material will be measured under relevant item of Schedule, if declared suitable or un-suitable.

### 1.2.12. Formation of Embankment in Water Logged Areas

1.2.12.1. Where embankments are to be placed in Water Logged areas and which are inaccessible to heavy construction equipment, a special working platform shall be first established, consisting of a blanket of fill material, placed on top of the soft layer.

1.2.12.2. The material for the working table shall consist of normal or processed granular fill, obtained from borrow excavation. This material shall conform to the specifications given in Table 1-9:-

**TABLE 1-9**

| Sieve Designation | Percent Passing by Weight |
|---|---|
| 75 mm (3 inch) | 100 |

1.2.12.3. The remaining grading shall be such, that intrusion into the working platform material of sub grade or natural ground surface is avoided. To meet this condition, following relationship is required:-.

$$\frac{D15 \text{ (for Working Platform Material)}}{Das \text{ (for Natural Ground Material)}} < 5$$

Where, $D_{85}$ **and** $0_{15}$ ,mean the particle diameter corresponding to 85% and 15% respectively, passing (by weight), in a Grain Size Analysis.

Construction of this working table shall proceed from one edge of the soft area by using the fill as a ramp for further material transport. The thickness of the working table as prescribed above shall be approximately 0.5 **M** unless directed otherwise by the Engineer-in-Charge, and the width shall be that of the embankment. The placement and compaction of the working table shall be carried out by use of light equipment, as directed by the Engineer-in-Charge. No density requirements are specified for the working platform, however for subsequent layers above, it shall be compacted to the densities specified above.

## METHOD OF MEASUREMENTS

**1.2.13. Measurement.** The quantities to be paid for shall be the number of cubic meters (cum) calculated on theoretical designed lines, grades and the ground levels, as established earlier, compacted in place, accepted by the Engineer-in-Charge, formed with material resulting from:-

1.2.13.1 **Formation of Embankment from Borrow Excavation.** Measurement shall be made as under:-

Formation from Borrow Excavation = Total Embankment Quantity ***(minus)*** Roadway Excavation Quantity ***(minus)*** Structural Excavation Quantity.

1.2.13.2. **Formation of Embankment from Structural Excavation.** This quantity shall be the same as calculated for structural excavation, irrespective of its haulage distance, except, that declared unsuitable by the Engineer-in-Charge.

1.2.13.3. **Formation of Embankment from Roadway Excavation.** This quantity shall be the same as calculated for roadway excavation. The contractor will be supposed to use material from roadway excavation, irrespective of haulage distance. However, if contractor, for his own convenience, uses the material from borrow, the payment will still be made under the item of embankment from roadway excavation.

**1.2.14.** In measurement of "Formation of Embankment on steep slopes", no allowance will be made for the benching or volume of material, cut out from the hill side or from the first half width fill to accommodate the compacting equipment, but will be calculated only on the net volume of fill placed against the original hill sides, the old embankment or the first half width fill.

**1.2.15.** The quantity of improved subgrade to be paid for shall be measured in square meter by the theoretical area covered in place as shown on Drawings, completed and accepted improved subgrade in a thickness of 30 ems.

**1.2.16. Clearing and Grubbing**

1.2.16.1. This item shall be paid as per the relevant item of Schedule at the location where required and approved for such purpose by the Engineer-in-Charge.

1.2.16.2. It shall not be measured for payment of work carried out by Contractor in cut areas of roadway and borrow pits.

## CLARIFICATION OF RATES

**1.2.17. The rates, inter alia, include particularly:-**

(1) Formation of embankment from borrow excavation including cost of excavation, royalty, hauling within 5 Km and filling upto any height/ lift, spreading, compaction, labour, equipment, tools and incidentals, necessary to complete the item.

(2) The accepted quantities measured in improved subgrade shall be paid for at unit price in the Bill of Quantities, and payment shall constitute full compensation for furnishing all materials, hauling, mixing, placing in layers, watering and compacting, labour, equipment, tools and incidentals necessary to complete the work prescribed.

(3) No extra payment will be made for making ramps/ platforms for borrow pits.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Buildings** | | |
| | **Foundation, Trenches, Wells etc** | | |
| 1-1 | **Excavation** as in **Ordinary Soil upto 1.5 M depth,** in foundation and pipe trenches upto 1.5 M wide, in shafts, wells and independent holes upto 30 sqm each and throw earth clear of edges of excavation within 1Orn. Timbering to be paid extra (Foundation and Trench over 1.5 M widths will be treated as **Areas).** | Cum | 221 |
| 1-2 | Same as item 1-1, but in **Hard Soil.** | Cum | 260 |
| 1-3 | Same as item 1-1, but in **Rock not requiring blasting.** | Cum | 2053 |
| 1-4 | Same as item 1-1, but in **Rock requiring blasting.** | Cum | 1718 |
| 1-5 | Same as item 1-1, but in **Rock requiring blasting but blasting is prohibited.** | Cum | 3501 |
| 1-6 | Add to item 1-1 to 1-05 for each additional 1.5 M lift or part thereof | Cum | 225 |
| 1-7 | **Excavation over areas** as in **Ordinary/Hard Soil** upto **1.5 M** depth, in foundation **/** excavations, throw earth clear of edges of excavation within 50 M. | Cum | 207 |
| 1-8 | Same as item 1-7 but **1.5 M to 3M** depth. | Cum | 404 |
| 1-9 | Same as item 1-7 but **3M and upto 6 M** depth. | Cum | 448 |
| 1-10 | Same as item 1-7 but **6 Mand upto 9 M** depth. | Cum | 477 |
| 1-11 | Same as item 1-7 but **9 Mand upto 12 M** depth. | Cum | 527 |
| 1-12 | **Excavation over areas** as in **Rock** upto **1.5 M** depth, in foundation / to obtain earth for filling under floors **/** areas etc., or for shafts, wells exceeding 30 sqm each, throw earth clear of edges of excavation within 50 M. | Cum | 1454 |
| 1-13 | Same as item 1-12, but in **Rock through blasting.** | Cum | 710 |
| 1-14 | Same as item 1-12, but in **Rock requiring blasting but blasting prohibited.** | Cum | 2824 |
| 1-15 | Add to item 1-7 to 1-14 for each additional 1.5 M lift or part thereof | Cum | 150 |
| | **Earth Filling** | | |
| 1-16 | Earth filling as in **Ordinary or hard soil,** filling in foundation, pipe trenches, shafts, wells, independent holes, under floors or around plinths etc., 1.5 M below or above Ground Level (GL), with spoil obtained from excavation in trenches/over areas within 50M including watering and compaction in 150 mm layer and dressing to required profile and shape. | Cum | 240 |
| 1- 17 | Add to item 01-16, for each additional 1.5 M or part thereof, above/ below GL. | Cum | 48 |
| | **Lead** | | |
| 1-18 | Load **"materials"** (like excavated soil / rock, demolished brick bats, bricks, sand and bitumen etc.), by any means (specified in items 1-1 to 1-15) upto 1000 M, unload and stack or spread. | Cum | 339 |
| 1- 19 | Add for canying soil / rock demolished brick bats, bricks, sand and bitumen etc.), by any means, for each subsequent 1000 Mor part thereof (specified in items 1-1 to 1-15), unload and stack or spread. | Cum | 78 |
| | **Miscellaneous** | | |
| 1- 20 | Excavate hill side slips, or similar loose material of any description and remove to a distance not exceeding 25M and deposit where directed, (loose or packed measure to be converted into solid measure). | Cum | 286 |
| 1- 21 | Finish the surface of existing embankments in repair to a neat and finished profile including making up where necessary, (earth utilized from borrow pjts for making up be paid for extra). | Sqm | 11 |
| 1- 22 | **Compaction** / **Ramming Earth** in 150mm layers except watering. | Cum | 36 |
| 1-23 | **Compaction/ Ramming Earth** in150mm layers with **Watering.** | Cum | 43 |
| 1-24 | **Brick bats** or other approved filling in soakage pits etc. | Cum | 6128 |
| 1- 25 | **Taking out** brick bats, boulders, rubbish etc, **from Soakage pits** and dispose off as ordered (supply and filling of brick-bats or other approved filling not included). | Cum | 678 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 1-26 | **Pumping out water from excavation** etc, including all labour, use of pumps, plants etc (The net quantity raised to be paid for). The lift not to exceeding 12 M. *Conversion Factor 1000 lit = one Cum.* | Cum | 271 |
| | **Roads and Runways etc** | | |
| 1-27 | **Clearing and Grubbing,** all as specified. | Sqm | 17 |
| 1-28 | **Compaction of Natural Ground** upto **95% Modified AASHTO density** all as specified. | Sqm | 12 |
| 1-29 | Same as item 1-28 but 93% Modified AASHTO density. | Sqm | 12 |
| 1-30 | Same as item 1-28 but **90%** Modified AASHTO density. | Sqm | 10 |
| 1-31 | **Making Embankment,** with the specified /approved soil obtained from borrow excavation including Loading within Five KM, compactiol" in 150mm layers upto **95% Modified AAS.HTO density,** and dressing to required profile and shape as specified. | Cum | 445 |
| 1-32 | Same as item 1-31 but upto 93% Modified AASHTO density. | Cum | 374 |
| 1-33 | Same as item 1-31 but **90%** Modified AASHTO density. | Cum | 347 |
| 1-34 | Cutting of ordinary / hard soil of roadway / Runway / Hard standing stripping etc. and dispose off/ collect spoil within 5 KM, complete, all as specified. | Cum | 221 |
| 1-35 | Cutting of **Rock not requiring blasting** of roadway etc. and disp::>se off / collect spoil within Five (5) KM, complete, all as specified. | Cum | 3123 |
| 1-36 | Same as item 1-35 but as in **Rock requiring blasting.** | Cum | 1606 |
| 1-37 | Same as item 1-35 but as in **Rock requiring blasting, but blasting prohibited.** | Cum | 6342 |
| 1-38 | Add for carrying material obtained as specified in items 1-35 to 1-37, for each sub sequent Five(5) KM or part thereof. | Cum | 230 |

SECTION-2

# ROADS AND RUNWAYS

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AijTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-2

# ROADS AND RUNWAYS

## SPECIFICATIONS

**2.0.** This Section covers Roads and Runways. (Detail instructions are covered in Technical Instructions, Volume - II Roads and Runways). The items related to excavation and earth work have been discussed in Section-1. The material and construction requirements for following items are covered in this section:-

(1) Sub Base. Granular Sub Base and Soil Aggregate Sub Base
(2) Base. Aggregate Base Course and Water Bound Macadam (WBM)
(3) Asphaltic Hot Surface Treatment
(4) Premix Carpet (Bit-Mac)
(5) Prime Coat/ Tack Coat/ Seal Coat
(6) Asphaltic Courses (Plant Mix)
  (a) Asphaltic Base Course
  (b) Asphaltic Wearing Course
(7) Concrete Pavement for Roads and Runways.
(8) Pavement Quality Concrete (PQC)
(9) Rapid Runway Repairs
(10) Runway Joints and Sealants
(11) Reflectorized Pavement Studs
(12) Speed Breakers

### 2.1. Sub Base

2.1.1. **Granular Sub Base.** All naturally occurring materials, meeting the requirements mentioned in Table 2-1 and 2-2.

**MATERIAL REQUIREMENTS**

**TABLE 2-1**

**Grading Requirements**

(For **Roads Only, for Runways / Airfields Refer to Volume-** II of Technical **Instructions, No. R-84)**

| **Sieve Designation** | | **Percent Passing by Weight** | |
|---|---|---|---|
| **mm** | **(inch/ No.)** | **Grading A** | **Grading B** |
| 60 | 2-1/2 in | 100 | - |
| 50 | 2 in | 90-100 | 100 |
| 25 | 1 in | 50-80 | - |
| 9.5 | 3/8 in | - | 55-85 |
| 4.75 | No. 4 | 35-70 | 40-70 |
| 2.0 | No. 10 | - | 30-60 |
| 0.425 | No. 40 | - | 20-50 |
| 0.075 | No.200 | 2-8 | 5-15 |

**Note:-** The Uniformity Co-efficient, Cu= (D60/ D10) shall not be less than 3, where D60& D10 are the particle diameter corresponding to 60% &10% respectively, passing (by weight) in Grain Size Distribution curve.

**TABLE 2-2**

**Other Properties of Granular Sub-Base**

| | |
|---|---|
| CSR Value (Tested as per AASHTO T-193)<br>(1) Roads<br>(2) Runways | <br>30% (Min)<br>35% (Min) |
| Liquid Limit (L.L) | 25 (Max) |
| Abrasion Value | 50% (Max) |
| Sand Equivalent (S.Eq) | 25 (Min) |

2.1.2. **Sub Base (Soil Aggregates).** Soil aggregates, available in nature consisting of pebbles, shingle and sand may be used as such, if approved by the Engineer-in-Charge. It may be a mixture of natural and crushed stone. The pebble size should not exceed 60 mm (2½").

## CONSTRUCTION REQUIREMENTS

2.1.3. Construction Requirements of Sub-Base material of a single layer are given in Table 2-3.

**TABLE 2-3**

| Compacted Single Layer Thickness | | Min Compaction (Field Density) | Tolerance | |
|---|---|---|---|---|
| Max | Min | | Thickness | Cross fall |
| 15cm | 7.5cm | 98% of MDD determined as per ASTM -D 1557 | +10mm -20mm | ±0.3 % |

**Notes:-**

(1) Use hard, suitable and approved locally used materials, unless otherwise required to suit above specifications.

(2) Lay to full depth, hand pack on edge, fill interstices with spalls of sub-base material.

(3) Lay to gradients, camber and super-elevation required and dry roll to a solid even finish, with 8 - 12 Ton power roller. The actual weight of the roller may be changed at the discretion of the Engineer-in-Charge, according to the nature of soil and the (bottoming) sub base materials used.

(4) Make good with spalls of bottoming materials any voids, which may appear during the process of compaction and rolling, so as to leave the finished surface solid and conforming to the required slopes, levels, etc.

(5) The thickness refers to the thickness after compaction.

## 2.2. Base Course

2.2.1. **Aggregate Base Course.** It is a foundation course, consisting of crushed hard durable gravel, rock or stone fragments. It shall be clean and free from organic matters, lumps of clay and other deleterious substances. The material shall be of such a nature that it can be compacted readily under watering and rolling to form a firm, stable base for both Flexible and Rigid pavements.

## MATERIAL REQUIREMENTS

2.2.1.1. The Aggregate Base Course shall comply with Grading and Quality requirements given in Table 2-4 and 2-5.

**TABLE 2-4**

**Grading Requirement of Aggregate Base Course**

| Sieve Designation | | Percent Passing by Weight | |
|---|---|---|---|
| mm | In/ No | Grading A | Grading B |
| 50.0 | 2in | 100 | 100 |
| 25.0 | 1 in | 70-95 | 75-95 |
| 9.5 | 3/8 in | 30-65 | 40-75 |
| 4.75 | No.4 | 25-55 | 30-60 |
| 2.00 | No. 10 | 15-40 | 20-50 |
| 0.425 | No. 40 | 8-20 | 12-25 |
| 0.075 | No.200 | 2-8 | 5-10 |

**Note:** -

(1) The material shall be well graded such that Coefficient of Uniformity, Cu= $D_{50} / D_{10}$ shall be greater than **4.**

(2) The gradation curve of the material shall be smooth and within the limits for Grading A or B given in Table 2-4.

**TABLE 2-5**

**Quality Requirements of Aggregate Base Course**

| | |
|---|---|
| Crush Aggregate particles by weight having minimum of two fractured faces | 90% (Min) |
| Laminated Material Value | 15% (Max} |
| **C.B.R** Value | 80% (Min) as determined according to AASHTO T-193 |
| Los -Angeeles Abrasion Value | 40% (Max) |
| Loss when subject to five cycles of the Na2 SQ4 Soundness Test | 12% (Max) as determined according to AASHTO T-104 |
| Sand Equivalent (S.Eq) Value | 45% (Min} as determined according to AASHTO T-176 |
| Plasticity index (PI} Value. | 6 (Max} as determined according to AASHTO T-90 |

2.2.1.2 **Filler.** The approved Filler for blending or addition to that already present in the Aggregate Base material shall conform to requirements given in Table 2-6.

**TABLE 2-6**

**Requirements for Filler Material**

| Requirements | Sieve Designation | | |
|---|---|---|---|
| | 9.5 mm (3/8 in.) | No.4 | No. 100 |
| Percent Passing by Weight | 100 | 85-100 | 10-30 |
| P.1. Value (AASHTO T-90) | 6 (Max) | - | - |
| S. Eq. (AASHTO-T-176) | 30 (Min) | - | - |

## CONSTRUCTION REQUIREMENT

2.2.1.3. Construction Requirements for Aggregate Base Course are given in Table 2-7

**TABLE 2-7**

| Layer Thickness | Field Compaction as per AASHTO T-180 (Method - D) | Tolerance | |
|---|---|---|---|
| | | Layer Thickness | Cross Fall |
| 15 cm (Max) | 100% (Min) | +50mm<br>-10 mm | ±0.2 % |

**Note:** - For road works exceeding 10 Km in Length, prior to commencement of Aggregate Base Course operations, a trial section 4 M wide of 200 to 300 M length, if directed by the Engineer-in-Charge shall be prepared at site by the Contractor, using same material and equipment as will be used at site to determine the adequacy of equipment & other construction parameters.

2.2.2. **Water Bound Macadam (WBM) Base.** It consists of broken stones of irregular shape, keyed together by consolidation under a roller, the stones themselves being wedged together in position and prevented from moving by smaller stones. Water is used to wash smaller particles of stones and grit into voids from above. Stability of WBM depends upon binder material, which holds the stones in position and prevents them being moved or displaced under traffic.

## MATERIAL REQUIREMENTS

2.2.2.1. The requirements are highlighted in succeeding paras.

2.2.2.2. **Coarse Aggregate**

(1) **Grading.** Crushed or broken stone shall conform to requirements as specified in Table 2-8.

**TABLE 2-8**

**Grading Requirement - Coarse Aggregates**

| Sieve Designation | | Percent Passing by Weight | | |
|---|---|---|---|---|
| mm | In | Class-A | Class-B | Class-C |
| 102 | 4 | 100 | - | - |
| 89 | 3-1/2 | 90-100 | - | - |
| 76 | 3 | - | 100 | - |
| 63.5 | 2-1/2 | 25-60 | 90-100 | 100 |
| 50 | 2 | - | 25-75 | 90-100 |
| 37.5 | 1-1/2 | 0-15 | 0-15 | 35-70 |
| 25 | 1 | - | - | 0-15 |
| 19 | 3/4 | 0- 5 | 0-5 | 0-5 |
| 12.5 | 1/2 | - | - | - |

(2) **Physical Properties** of Coarse Aggregate are given in Table 2-9.

**TABLE 2-9**

**Physical Properties of Coarse Aggregates**

| Los Angeles Abrasion Value | Flakiness Index (F.I.) | Loss as per Soundness Test when subjected to 5 cycles of Na2 S04 |
|---|---|---|
| 45% (Max). | 15% (Max). | 20% (Max) tested as per AASHTO T-104 |

2.2.2.3. **Fine Aggregate (Filler Material or Screening).** The Fine aggregate shall be of following gradation:-

**TABLE 2 -10**
**Fine Aggregate - Gradation Requirement**

| Sieve Designation | | Percent Passing by Weight |
|---|---|---|
| **Mm** | **In** | |
| 9.5 | 3/8 | 100 |
| 4.75 | No. 4 | 85-100 |
| 0.15 | No. 100 | 10-30 |

**Note:** -The material passing Sieve # 40 shall have a Liquid Limit (LL) of not more than 25 and Plasticity Index (PI) of not more than 6.

## CONSTRUCTION REQUIREMENTS

2.2.2.4. Following are the Construction Requirements of laying **Water Bound Macadam (WBM) Base:-**

(1) For existing road surface 50 mm x 50 mm furrows shall be cut at One meter (1M) interval at 45° to the centerline of the roadway before proceeding with the laying of Coarse aggregates.

(2) Use approved hard, tough and durable stone.

(3) Road material to be graded, produced from broken or crushed quarried stone or large boulders, least dimension not less than 150 mm.

(4) The completed Base course shall be maintained in an acceptable condition until necessary subsequent treatment is applied.

2.2.2.5. **Spreading and Compaction**

(1) Crushed stone shall be deposited and spread over prepared surface to proper depth so that the compacted layer shall not exceeding 2 ½ times the thickness of Max Size of Aggregate. Each layer shall be inspected thoroughly before rolling to detect high or low spots. Crushed stones shall be added or shifted to provide a true surface. The coarse aggregate layer, after being laid to proper thickness, shall be lightly rolled, sufficient only to establish the required grade and level of the stones.

(2) Lay to gradient, camber and super-elevation as required and dry roll, filling the depressions which may appear during rolling. Spreading of aggregate shall be followed by rolling with a smooth wheel roller weighing 10 Tons. Rolling shall begin at the lower edge of the shoulders to lock the stones firmly at the edge, then progress gradually towards center line. Rolling shall continue until aggregate is well keyed and does not creep ahead of the roller.

(3) After the initial rolling, dry screening shall be applied uniformly over the surface. Dry rolling shall be continued while screenings are being applied. The surface shall be swept with mechanical or hand brooms to aid spreading of the screenings. In no case, shall coarse aggregates be stored in heaps directly on the area where these are to be laid or shall their hauling over a partly completed base be permitted, however dumpers shall be allowed at the construction area, where material will be spread quickly after dumping.

(4) When the interstices in the coarse aggregate are filled with screening, the surface shall be sprinkled with water until it is saturated. The rolling, sprinkling and application of additional screening shall continue until a grout is formed that fills all the voids and forms a wave of grout in front of the roller.

(5) When more than one layer is required to complete the Macadam Base course to the required thickness as per the drawings, each layer shall be constructed as described.

**2.3. Bituminous Surface Treatment.** It is the application of asphaltic materials on any type of road or pavement surface, with or without a cover of mineral aggregates, which produces an increase in thickness of less than 25 mm (1").

## MATERIAL REQUIREMENTS

2.3.1. **Aggregates**

2.3.1.1. The Properties of Aggregates are given in Tables 2-11 & 2-12.

**TABLE 2-11**
**Properties of Aggregates**

| | |
|---|---|
| Los Angeles Abrasion Value | 40 (Max) as per ASTM C 131 |
| Aggregate Crushing Value (ACV) | 25% (Max) as per BS-812 |
| Weight loss when subjected to 5 cycles of Na2 S04 | 10% (Max) as per AASHTO T-104 |
| Flakiness Index (F.1.) | 25% (Max) as per BS-812 & 30% (Max) for 9 mm nominal size |
| Moisture Content by Weight | 3% (Max) |

2.3.1.2. All aggregates shall be known by their grade / gauge according to Table 2-12, subject to 10% excess or shortage of any material of any gauge enumerated therein.

**TABLE 2-12**

**Grading of Aggregates**

| Grade of Aggregates | Proportional parts by volume | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gauges | | | | | | | | | | |
| | 63 mm | 50 mm | 38 mm | 25 mm | 19 mm | 13 mm | 10 mm | 6 mm | 3 mm | 2 mm | 1 mm |
| **63 mm graded** | 10 | - | 5 | - | 3 | - | 2 | - | - | - | - |
| **50 mm graded** | - | 10 | 5 | - | 3 | - | - | 2 | - | - | - |
| **38 mm graded** | - | - | 10 | 5 | - | 3 | - | 2 | - | - | - |
| **25 mm graded** | - | - | - | 10 | 5 | 3 | - | 2 | - | - | - |
| **19 mm graded** | - | - | - | - | 10 | 5 | - | 3 | 2 | - | - |
| **13 mm graded** | - | - | - | - | - | 10 | 5 | 3 | 2 | - | - |
| **10 mm graded** | - | - | - | - | - | - | 10 | 5 | 3 | 2 | - |
| **6 mm graded** | - | - | - | - | - | - | - | 10 | 5 | 3 | 2 |

2.3.2. **Asphaltic Material for Surface Treatment.** The asphaltic material shall be Asphalt Cement (AC), emulsified or cutback asphalt as specified or directed by the Engineer in Charge.

2.3.2.1. **Asphalt.** A class of black or dark coloured (solid, semisolid, or viscous) cementatious substances, natural or manufactured, composed principally of high molecular weight hydrocarbons, of which asphalts, tars are typical.

2.3.2.2. **Asphalt Cement (AC).** Asphalt that is refined to meet specifications for paving, industrial and special purposes. Its penetration is usually 40-300. For AC, refer to ASTM-D 946 and AASHTO M-20 & M-226.

2.3.2.3. **Cut Back Asphalt.** Asphalt Cement (AC), which has been liquefied by blending with petroleum solvents (also called diluents). On exposure to atmosphere the diluents evaporate, leaving AC to perform its function. The types are given below:-

(1) **Rapid Curing (RC).** It is composed of AC and a Naphtha or Gasoline type diluents of high volatility (ASTM D-2028 & AASHTO M-81).

(2) **Medium Curing (MC).** It is composed of AC and Kerosene type diluents of medium volatility (ASTM D-2027 & AASHTO M-82).

(3) **Slow Curing (SC).** It is composed of AC and oil/ diluents of low volatility (ASTM D-2026 & AASHTO . M-141).

2.3.2.4. **Emulsified Asphalt.** An emulsion of AC and water that contains a small amount of Emulsifying agent, in which water forms a continuous phase of emulsion and minute globules of asphalt form the discontinuous phase.

## CONSTRUCTION REQUIREMENTS

2.3.3. The Construction Requirements of Asphaltic Surface Treatment are appended below:-

(1) **Weather / Temperature.** At the time of application, the weather shall be warm & dry, and the road surface shall be clean / tidy and dry. Spraying shall not be done unless the road temperature is above 20°C for at least 1 hour prior to the commencement of operation.

(2) **Application Temperatures.** Spraying / mixing temperature for Hot Dressing / Treatment shall conform to Table 2-13, 2-14 and 2-15.

**TABLE 2-13**

**Application Temperature for Asphalt Cement (AC)**

| Asphalt Cement (Penetration) | Spraying Temperature (°C) (Min) |
|---|---|
| 200 - 300 | 130 |
| 120 -150 | 130 |
| 80 -100 | 140 |
| 60 - 70 | 145 |
| 40- 50 | 150 |

**TABLE 2-14**
**Application Temperature for Emulsified Asphalt**

| Emulsified Asphalt | Mixing Temperature (°C) | Spraying Temperature (°C) |
|---|---|---|
| RS-1, RS-2 | - | - |
| MS-1 | 10-70 | 20-70 |
| MS-2 | 10-70 | 20-70 |
| SS-1 | 10-70 | 20-70 |
| CRS-1 | 10-70 | 20-70 |
| CSS-1 | 10-70 | 20-70 |

**TABLE 2 -15**
**Application Temperature for Cutback Asphalt**

| Cut-back Asphalts (RC,MC,SC) | Mixing Temperature (° C) | Spraying Temperature (° C) (Min) |
|---|---|---|
| 70 | - | 20 |
| 250 | 55- 80 | 40 |
| 800 | 75 -100 | 55 |
| 3000 | 80 -115 | - |

(3) Application of Asphaltic materials shall be carried out by means of approved Pressure distributor, manual or auto, at the temperature specified for the type and grade of asphalt being used. The rate of application for aggregate and asphaltic material shall be as given in Table 2-16.

(4) The mechanical / manual equipment should be operated especially, by trained manpower for spraying.

(5) Irregularities and surface damage e.g. pot-holes, depressions and raveling be corrected prior to surface dressing.

**TABLE 2 -16**
**Quantities of Materials for Surface Treatment**

| Surface Treatment | | Aggregate | | Asphaltic Material | |
|---|---|---|---|---|---|
| **Type** | **Application** | **Gauge** | **Quantity Cum/Sqm** | **Quantity (Kg./Sqm)** | **Type** |
| **Single (ST)** | On Old Surface | 6mm | 0.012 | 1.22 | (a) |
| | | | | 1.465 | (b) |
| | On Base Course | 13 mm (2/3) | 0.015 | 1.95 | (a) |
| | | 10 mm (1/3) | | - | (b) |
| **Double (on Base Course) (DST)** | First Coat | 13 mm | 0.018 | 2.20 | (a) |
| | | | 0.015 | 1.85 | (b) |
| | Second Coat | 6mm | 0.015 | 1.22 | (a) |
| | | | 0.011 | 1.37 | (b) |
| **Triple (on Base Course) (TST)** | First Coat | 13 mm | 0.018 | 2.2 | (a) |
| | | | 0.015 | 1.85 | (b) |
| | Second Coat | 6mm | 0.015 | 1.22 | (a) |
| | | | 0.011 | 1.37 | (b) |
| | Third Coat | 3mm | 0.008 | 0.61 | (a) |
| | | | 0.006 | 0.69 | (b) |

**Note:** - Bituminous material types (a) Asphalt Cement/ Bitumen (b) Cut-back or Emulsified

2.3.4. **Procedure for Asphaltic Surface Treatment**

2.3.4.1. **Single Coat work (On existing asphaltic surface).** It shall be used as in renewals of Surface Dressing on Old Asphaltic Surface.

(1) Allow the surface to be perfectly dry, before priming.

(2) Rake all caked mud, dust, dirt, or other deleterious materials, by hand/mechanical means with wire brushes/brooms and finally dust the surface with gunny bags to leave the surface perfectly clean.

(3) Spray at the rate specified in Table 2-16. In Hot dressing, aggregates shall be heated in a proper heating plant to the temperature ranging between the minimum and maximum temperature, specified

by the manufacturer or in these specifications and shall be applied to the road surface by means of pressure sprayer. The sprayer shall be operated in such a way as shall ensure an even and uniform distribution of the hot bitumen on the road surface.

(4) Excessive deposits of bitumen on the road shall not be allowed. Spraying shall in all cases be carried out within the outer limits approved by the Engineer-in-Charge. The edges of the surface to be treated with hot dressing shall be defined by wire, binder, twine or other cord line stretched and pegged in position.

(5) Immediately following the application of the hot dressing, spread aggregate consisting of broken or crushed stone, gravel or shingle. The aggregate shall be perfectly dry, free from foreign matter and shall be spread uniformly and evenly on the bituminous surface at the rate described above. Precaution shall be taken to ensure that whole of the surface is covered with a uniform layer of aggregate, without any accumulation of surplus aggregate at any point. Hand brooming or light drag brooming shall follow the application of the aggregate prior to rolling. The aggregate consisting of elongated material shall not be used.

(6) Immediately after the completion of brooming as specified above, roll the whole area with appropriate compaction equipment / roller. The rolling shall continue till the aggregate is thoroughly embedded in the bituminous surface.

(7) Open the road to traffic as directed by the Engineer-in-Charge or as otherwise specified by the manufacturer nf the asphaltic material used.

2.3.4.2. **Single Coat work (On new base course).** It may be considered as first layer of Double/ Triple Surface treatment on Base Course not previously treated with hot dressing.

(1) Allow Base Course surface to dry to depth of 50mm.

(2) Rake all caked mud, dust, dirt or other deleterious material with wire brushes and brooms and finally dust the surface with gunny bags to leave the voids perfectly clean.

(3) All as Paras 2.3.4.1 (1) to (7).

2.3.4.3. **Two-Coat work.** It involves successive treatments on Base Course Surface not previously treated with hot dressing.

(1) **First Coat.** All procedures as for Single Coat work described above, but the rate of application of bitumen and aggregate as per Table 2-16.

(2) **Second Coat.** This shall be applied immediately after the First Coat. The work shall be done in all respects as described above, but the rate of application is as per Table 2-16.

(3) **Similarly, Three-Coat work** is to be carried out as above, with the rate of application for TST as per Table 2-16.

**2.4. Premix Carpet (Bit Mac).** This consists of furnishing and mixing aggregates with asphalt binder at site in mobile mixing plant, spreading, compacting on an approved primed base course, pot-hole repair, leveling course and wearing course, in accordance with the specifications and in conformity with the lines, grade, thickness and typical cross-section shown on drawings or as directed by Engineer-in-Charge.

## MATERIAL REQUIREMENTS

2.4.1. **Mineral Aggregates.** Mineral aggregates for Bit-mac shall consist of Coarse aggregate, Fine aggregate and Filler material, all conforming to specifications given below:-

(1) Coarse aggregate is the material passing 25.4 mm (1") Sieve and retained on Sieve # 4, shall consist of crushed rock, crushed boulder, or crushed gravel. It shall be clean, hard, tough, sound, durable, and free from decomposed stones, organic matter, shale, clay lumps or other deleterious substances.

(2) All aggregates shall be known by their grade according to Table 2-12, subject to 10% excess or shortage of any material of any gauge enumerated therein.

(3) Fine aggregate is the material passing Sieve # 4 and shall consist of crushed sand. The grading requirements as per ASTM C - 33 are given in Table 2-17

(4) When combined gradation of Coarse and Fine aggregates is deficient in material passing Sieve # 200, mineral filler shall be added, which shall consist of finely divided rock dust from sound rock, hydrated lime or hydraulic cement. At the time of use, it shall be sufficiently dry to flow freely, free from lumps.

(5) Aggregate shall be stored on hard clean surface to facilitate prompt inspection and control. When aggregates containing a wide range of sizes are to be used, they must be stockpiled separately to prevent intermingling. Mineral filler must be protected from moisture to eliminate caking and hardening.

**TABLE 2-17**
**Fine Aggregates (Sand) - Grading Requirements**

| Normal size | Sieve No. | % age Passing by Weight |
|---|---|---|
| 9.50 mm | 3/8 inch | 100 |
| 4.75 mm | No. 4 | 95-100 |
| 2.36 mm | No. 8 | 80-100 |
| 1.18 mm | No. 16 | 50-85 |
| 0.60 mm | No. 30 | 25-60 |
| 0.30 mm | No. 50 | 10-30 |
| 0.15 mm | No. 100 | 2-10 |

2.4.2. **Asphaltic Binder.** Asphaltic binder used shall conform to Standard specification of petroleum asphalt having grades 60/70 or 80/100 penetration. Generally, it will meet the requirement of MSHTO M-20, as per Table 2-25.

2.4.3. **Quantity of Material for Premix Carpet (Bit Mac).** Use Table 2-18 for laying 10 Sqm of 50 mm thick (0.50 Cum) consolidated carpet, mix of materials as per Table 2-18 has been incorporated in the Schedule items 02-58 to 02-65.

**TABLE 2-18**
**Material Required for Premix Carpets (Bit Mac)**

| Item | | | Hot Dressing Asphalt Bitumen 60/70 or 80/100 |
|---|---|---|---|
| 1 | a | Tack Coat on asphaltic / concrete surface | 4.88 Kg |
| | b | Prime Coat on Base Course | 10 Kg |
| 2 | | Asphalt cement for Premix | 61.75 kg |
| 3 | | Aggregates 13 mm graded, consisting of broken or crushed stone or gravel or shingle (gravel/shingle for light traffic only) | 0.54 Cum |
| 4 | | Sand | 0.14 Cum |

**CONSTRUCTION REQUIREMENTS**

2.4.4. **Mixing Requirement**

2.4.4.1. Asphalt Cement (AC) shall be heated to a maximum temperature of 163°C at the time of mixing. AC heated above 163°C shall be rejected. Temperature of asphalt shall be checked frequently. Each aggregate ingredient shall be heated to temperature 150-160°C for at least six (6) minutes before mixing of AC to ensure complete drying of aggregates. The range of heating of aggregates shall be strictly followed, to ensure proper coating of aggregates. Fine aggregates shall be introduced into the dryer (mixer) first, followed by the Coarse aggregates to ensure proper mixing. Quantity of aggregates fed to dryer (mixer) must be accurately controlled by suitable measuring device (Steel gauge box) having predetermined volume of one (1) cuft or as instructed by Engineer-in-Charge.

2.4.4.2. Both bitumen and aggregates must be heated before they are combined in the mixer drum. Mixing temperature should be kept within the range of 140-163 °C.

2.4.4.3. To achieve uniform mixing and proper coating, aggregates and AC must be thoroughly mixed for minimum duration of ninety (90) seconds, which may be prolonged to hundred (100) seconds, if required.

2.4.5. **Deep Patches/ Pot holes.** The surface to receive Bit-Mac shall be prepared as mentioned under relevant item of these specifications and shall be primed to receive the premix in a thickness as per drawing or as directed by the Engineer-in-Charge. Compaction shall be done with equipment suited to the job. A vibratory plate compactor is recommended for small patches, whereas roller may be more effective for larger areas. Straight edge or string-line shall be used to check riding quality and alignment of the patch.

2.4.6. **Leveling Course.** All local depressions, corrugated surface, ripples across the pavement should be rectified before leveling course is placed. Clean the area free of dust or other loose material with mechanical broom or compressed air. Apply light Tack coat@ 0.488 Kg/ Sqm of A.C 80/100 penetration grade. After drying dense graded hot Bit-Mac, it shall be spread in layer not more than 7cm in thickness. Spread shall be done carefully to prevent segregation and compact with steel wheeled and pneumatic tyre roller. For small pot-holes, hand tempers shall be allowed. Use string-line to check the riding quality of the leveling course.

2.4.7. **Mini Mixing Plant.** Local made bitumen aggregate mixer equipment used for preparation of Bit-mac shall be in good working condition, of sufficient capacity, capable of being operated to produce uniform blend with given ingredients.

2.4.8. **Hauling Equipment.** Bit-mac mixed material shall be delivered in tight, clean and smooth metal bed hand trolleys, or any method as convenient to the Contractor and approved by the Engineer-in-Charge.

2.4.9. **Prime and Tack Coats.** The priming shall be done in a manner as described in item of Priming at the rate of application i.e. 1.0 Kg/ Sqm. Tack Coat shall be done in a manner as described in item of Tack Coat at the rate of application i.e. 0.488 Kg/ Sqm. When surface of existing pavement or old base is irregular, it shall be brought to uniform grade and cross-section by leveling course as described above.

2.4.10. **Spreading and Finishing.** Bit-mac mixture shall be placed on approved surface, struck off to required section manually with rakes or hand tools by experienced foreman, distributed over the entire width or partial width as required. All mixtures shall be spread at temperature not less than 140 °C. Mixture shall not be placed on any wet surface or when atmospheric temperature is below 5 °C or when the weather is foggy or rainy.

2.4.11. **Compaction.** Roller shall be Steel wheeled or Pneumatic tyred. The roller(s) shall be in good working condition, capable of reversing without backlash and capable to be operated at speeds slow enough to avoid displacement of Bit-mac. The number and weight of rollers shall be sufficient to compact the mixture while it is still in workable condition to obtain compaction to the satisfaction of the Engineer-in-Charge. The use of equipment which results in excessive crushing of aggregates shall not be permitted. Following points shall be taken care of:-

(1) Rolling will not be prolonged to avoid appearance of cracks. Rolling will be done longitudinally, beginning at the lower side of the spread and proceeding towards the higher side, overlapping successive trips by at least one half(½) the width of rear wheels of roller.

(2) Along forms, curbs, headers, walls and other places not accessible to the roller, mixture shall be thoroughly compacted with hot hand tampers or mechanical tampers.

(3) Any mixture that has become cold enough, mixed with dirt or is defective in any way shall be replaced with fresh hot mixture and compacted to conform the requirement.

## 2.5. Prime Coat/ Tack Coat/ Seal Coat

2.5.1. **Prime Coat.** It is application of a low viscosity liquid asphalt product to an absorbent surface. It is used to prepare an untreated base for an asphalt surface. The Prime penetrates into the base and plugs the voids, hardens the top and helps binding it to the overlying asphalt course. To be applied on Aggregate Base Course as well as WBM Base Course.

### MATERIAL REQUIREMENTS

2.5.1.1. Asphaltic material for Prime Coat shall be either asphalt cement, cut back or emulsified, whichever is specified, or as mentioned in Tables 2-13, 2-14 and 2-15.

### CONSTRUCTION REQUIREMENTS

2.5.1.2. Prime coat shall be applied when the surface is dry and broomed. The surface may be reasonably moist when emulsified asphalt is used.

2.5.1.3. The application is prohibited when weather is foggy or rainy or when atmospheric temperature is below 5°C, unless otherwise directed by the Engineer-in-Charge.

2.5.1.4. Primed surface shall be kept un-disturbed for at-least 24 hours, so that asphaltic material travels beneath and leaves the top surface in non-tacky condition.

2.5.1.5. The liquid asphaltic material shall be sprayed by means of pressure distributor of approved capacity @ 1.0 kg/ sqm on WBM Base Course and Aggregate Base Course.

2.5.1.6. Prime coated surface shall not be opened to traffic until it has penetrated and cured sufficiently.

2.5.2. **Tack Coat.** It is a light application of asphalt, usually asphalt emulsion diluted with water. It is used to ensure bond between the surface being paved and the overlying course. To be applied on Asphaltic Base Course and on concrete surface.

### MATERIAL REQUIREMENTS

2.5.2.1. Asphaltic material for Tack Coat shall conform to the requirements of AC, emulsified or cutback asphalt, as specified.

### CONSTRUCTION REQUIREMENTS

2.5.2.2. The Tack Coat shall be applied only when surface treated by power brooms and / or blowers is dry, free from loose material dirt or any other objectionable matter. ,

2.5.2.3 However, for emulsified asphalt, application may be made on a reasonable moist surface.

2.5.2.4. Application of Tack Coat be avoided in fog or rain.

2.5.2.5. **Rate of Application.** Tack Coat shall be sprayed by means of pressure distributor as given in Table 2-19:-

**TABLE 2 -19**

| Asphalt Type | Rate of Application (Kg. / Sqm) | Remarks |
|---|---|---|
| Asphalt Cement | 0.488 | on existing asphaltic surface |

**Note:** - Care shall be taken that the application of asphaltic material is not in excess of the specified quantity. Any excess Asphalt shall be blotted by Sand or similar treatment.

2.5.2.6. Equipment of recognized manufacturer for spraying of Tack Coat shall be pressure distributor of not less than 1000 lit capacity mounted on pneumatic tyres. A hand power spray attachment to an asphalt pressure distributor or other container along with allied accessories shall be furnished and be approved by the Engineer-in-Charge.

2.5.3. **Seal Coat.** It is a thin asphalt surface treatment used to waterproof and improve the texture of an Asphalt Wearing Course/surface. Depending on the purpose, Seal Coat may or may not be covered with aggregate. The main types of seal coats are aggregate seals, fog seals, emulsion slurry seals and sand seals.

**MATERIAL REQUIREMENTS**

2.5.3.1. Asphaltic material for Seal Coat shall be either asphalt cement, cut back or emulsified, whichever is specified or as mentioned in Tables 2-13, 2-14 and 2-15.

2.5.3.2. Fine aggregate is the material passing Sieve # 4 and shall consist of crushed sand.

**CONSTRUCTION REQUIREMENTS**

2.5.3.3. Generally, the Premix carpets may not require Seal Coat. However, in certain conditions, due to special considerations or technical reasons, the finished surface may require a Seal Coat. In case the Seal Coat is technically required, it shall be clearly specified and shown on the drawings by the designer. The work may only be undertaken after approval by the respective DW&CE.

2.5.3.4. If not specified differently by the designer, the Seal Coat shall consist of spraying heated bitumen @10 Kg, followed by uniform sprinkling of sand @ 0.10 Cum for every 10 Sqm of the surface.

## 2.6. Asphaltic Courses (Plant Mix)

2.6.1. **Asphaltic Base Course (Plant Mix).** The requirements cover Coarse Aggregates, Fine Aggregates, Filler and Asphaltic materials.

**MATERIAL REQUIREMENTS**

2.6.1.1. The material requirements of Asphaltic Base Course layer are given in Table 2-20, 2-21, 2-22 and 2-23.

**TABLE 2 -20**

**Requirements of Asphaltic Base Course**

| | |
|---|---|
| **Mineral Aggregates** | Consist of Coarse aggregate, Fine aggregate and Filler material. |
| **Coarse aggregates** | Coarse aggregate retained on AASHTO Sieve # 4, shall consist of crushed rock, gravel or boulder. Crushing shall be at least 95% by weight of material retained on AASHTO Sieve# 4, having at least two mechanically fractured faces. |
| **Fine aggregates** | Fine aggregate material passing Sieve # 4, shall consist of 100% crushed material from rock or boulder. |
| **Filler Material** | Filler shall be finely divided rock dust, hydrated lime or cement. |

2.6.1.2. Table 2-21 gives Grading requirements of **Asphaltic Base Course**

**TABLE 2 -21**

**Combined Aggregate Grading Requirement**

| US Standard Sieve | | Mix Designation | |
|---|---|---|---|
| | | **Class-A** Compacted thickness (70-90 mm) | **Class-B** Compacted thickness (50-80 mm) |
| **Mm** | **Inches** | % Passing by Weight | **%t Passing by Weight** |
| 50 | **2"** | 100 | - |
| 38 | 1-1/2" | 90-100 | 100 |
| 25 | **1"** | - | 75-90 |
| 19 | 3/4" | 56-75 | 65-80 |
| 12.5 | 1/2" | - | 55-70 |

| US Standard Sieve | | Mix Designation | |
|---|---|---|---|
| | | Class-A Compacted thickness (70-90 mm) | Class-B Compacted thickness (50-80 mm) |
| Mm | Inches | % Passing by Weight | %t Passing by Weight |
| 9.5 | 3/8" | - | 45-60 |
| 4.75 | No.4 | 23-40 | 30-45 |
| 2.38 | No.8 | 15-30 | 15-35 |
| 0.300 | No. 50 | 4-10 | 5-15 |
| 0.075 | No.200 | 3-6 | 2-7 |
| Asphalt Content by weight (% of total mix) | | 3 (Min) | 3 (Min) |

**Note:** - Table 2-21 holds good for guidance only

2.6.1.3. The Properties of Coarse and Fine Aggregates are as given in Table 2-22.

**TABLE 2 -22**

**Properties of Coarse & Fine Aggregate**

| | |
|---|---|
| **Los Angeles Abrasion Value** | 40% (Max) as per ASTM C-131 |
| **Loss when subjected to 5 cycles of Na2 SQ4 Soundness** | 12% (Max) as per AASHTO T-104 |
| **Sand Equivalence (S.Eq)** | 45 (Min) as perT-176 |
| **Plasticity Index (P.1)** | 6 (Max) as per T-90 |
| **Flakiness Index (F.I)** | 15% (Max). |
| **Elongation Index** | 15% (Max). |

2.6.1.4. **Filler.** When the combined grading of the Coarse and Fine aggregate is deficient in material passing Sieve# 200, additional Filler material shall be added which will conform to Table 2-23.

**TABLE 2 -23**

**Grading - Filler Material for Asphalt Concrete Base Course**

| US Standard Sieve | Percent Passing By Weight |
|---|---|
| No. 30 | 100 |
| No. 50 | 95-100 |
| No. 200 | 70-100 |

2.6.1.5. **Asphaltic Material.** Asphaltic binder to be mixed with the aggregate to Asphaltic base shall be asphalt cement (AC) having penetration grade 40/50, 60/70 or 80/100 as specified and shall meet the MSHTO M-20 requirements and provided in Table 2-24.

**TABLE 2 -24**

**Requirements for Asphalt Cement (AASHTO M-20)**

| Requirements | 40 / 50 | | 60 / 70 | | 80 / 100 | | 120 / 150 | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max | Min | Max |
| Penetration at 25°C (77°F), 100 g, 5 Sec. | 40 | 50 | 60 | 70 | 80 | 100 | 120 | 150 |
| Flash point, Cleveland Open Cup,° F (° C) | 450 (232) | - - | 450 (232) | - - | 450 (232) | - - | 425 (218) | - - |
| Ductility at 25°C (77°F) 5 cm per min, cm. | 100 | - | 100 | - | 100 | - | 100 | - |
| Solubility in Tri Chloro- Ethylene(%) | 99 | - | 99 | - | 99 | - | 99 | - |
| Thin Film Oven test, 3.2mm (1/8in.), 163°C (325°F), 5 hr Loss on heating(%) | - | 0.80 | - | 0.80 | - | 1.0 | - | 1.3 |
| Penetration, of residue, % of original. | 58 | - | 54 | - | 50 | - | 46 | - |
| Ductility of residue, at 25 °C (77°F) , 5 cm per min, cm. | - | - | 50 | - | 75 | - | 100 | - |

2.6.1.6. **Marshall Test Criteria.** Table 2-25 shows the limits for Asphaltic Base Course (Plant-Mix) material.

**TABLE 2 -25**

**Limits for Asphaltic Base Course (Plant-Mix) Material**

| | |
|---|---|
| Stability | 1000 Kg. (Min) |
| % Air Voids in Mix. | 4-8 |
| Loss in Stability in 24 Hours | 25% (Max). |
| Flow 0.25 mm (0.01 in.) | 8-14 |
| % Voids in Mineral Aggregate | According to Table 5.3 , MS-2 Asphalt Institute 6th Edition 1993 |
| Compaction, No. of blows each end of specimen | 75 |

2.6.1.7. **JMF -Asphaltic Base Course (Plant-Mix)**

(1) JMF will be established at least one week prior to production, jointly by the Engineer-in-Charge and the Contractor.

(2) JMF shall be established by Marshall Method of Mix Design according to the Asphalt Institute Manual series# 2 (MS-2), latest revision or as specified by designer.

(3) The JMF, with the allowable tolerance shall be within the range specified as above.

(4) The ratio of weight of Filler (passing Sieve # 200) to that of Asphalt shall range from 1 to 1.5, for areas where temperatures exceed 40o C.

(5) **Table No. 2-21 is for guidance only and JMF will be prepared to establish the final grading.**

(6) Following Specimen JMF for Asphaltic Base Course, applicable to MES Schedule Item 02- 82 has been given for estimation purposes. In case different mix formula is used, the rate shall be adjusted by deducting the cost of materials in the above formula and adding the material cost incorporated in the new JMF at "Material Supplied Only" rates given in Section-28 of this Schedule of Rates.

(a). Asphalt Cement Grade 60 / 70 4.00%

(b). Stone dust (Khaka) 24.00%

(c). Aggregate 1/2" 29.00%

(d). Aggregate 3/4" 24.00%

(e). Aggregate 1-1/2" 19.00%

(7) Density of Asphaltic Base Course be 2.24 T/Cum.

(8) Max Variation in Material from JMF. Variation in passing %age of materials for Mineral Aggregates as given below is allowed with respect to the gradation adopted for JMF.

(a). Retained No. 4 and larger ±7%

(b). Passing No. 4 to No. 10 sieve ±4%

(c). Passing No. 200 ±1.0%

(d). Asphalt Content ±0.3%

**CONSTRUCTION REQUIREMENTS**

2.6.1.8. •Table *?-26'* and Table 2-27 show the Construction Requirements of laying Asphaltic Base Course layer.

**TABLE 2 -26**

**Temperature of Mixtures at various stages**

| | |
|---|---|
| Temperature of Asphaltic Mix discharged from Plant | 150° C - 163° C |
| Delivery/ paving /rolling temperature of the Mixture | 130°c - 163°c |
| Rolling temperature (considering air temperature) | 165° C -190° C (sum of air temperature & Asphaltic mix temperature) |
| Temperature for initial breakdown rolling | 130°c (Min) |
| Final Compaction / Rolling Temperature | 110°c (Min) |

**TABLE 2 -27**

**Compaction Criterion**

| | | |
|---|---|---|
| Equipment for initial breakdown rolling | | Tandem Steel or three wheeled Steel roller (10-12 T) |
| Equipment for intermediate rolling | | Pneumatic tyred roller (9 wheel) 21 T |
| Min Density | | 97% of Laboratory compacted specimen made from Asphaltic material for Daily Marshall Density |
| Frequency for testing of Cores | | One core per 100 RM of each lane (or as directed by Engineer-in-Charge) |
| Tolerance | Cross- Fall(%) | ± 0.2 |
| | Thickness (mm) | + 3, -5 |

**Note:-**

(1) Hot asphaltic mixtures shall be placed only when the air temperature is 4°C or above. No asphalt shall be laid under foggy or rainy weather or over moist surface.

(2) When thickness is deficient by more than 5 mm, it shall be made up by Asphaltic Base Course/ Wearing Course material, of reasonable thickness as approved by Engineer-in-Charge, without extra cost to the employer.

2.6.2. **Asphaltic Wearing Course (Plant Mix).** Table 2-29 shows the material requirements of Asphaltic Wearing Course layer. The material requirements cover Coarse aggregates, Fine aggregates, Filler material and Asphaltic materials.

**MATERIAL REQUIREMENTS**

2.6.2.1. **Mineral Aggregates** shall conform to physical properties given below:-

(1) **Coarse Aggregate** is the material retained on an AASHTO Sieve # 4 consisting 100% crushed rock or crushed gravel having minimum 2 faces mechanically crushed.

(2) **Fine Aggregate** is the material passing from AASHTO Sieve # 4 consisting 100% crushed material from rock or boulder.

(3) When the Combined grading of Coarse and Fine aggregates is deficient in material passing Sieve# 200, approved mineral Filler material shall be added conforming to details shown in Table 2-28.

**TABLE 2 -28**

| **Sieve Designation** | | **Percent Passing by Weight** |
|---|---|---|
| **mm** | **Sieve No.** | |
| 0.600 | No. 30 | 100 |
| 0.300 | No. 50 | 95-100 |
| 0.075 | No.200 | 70-100 |

**TABLE 2 -29**

**Other Properties of Mineral Aggregates**

| | |
|---|---|
| Los Angeles.Abrasion Value | 30% (Max) as per ASTM C 131 |
| Loss when subjected to 5 cycles of Na2 S04 Soundness Test | 12% (Max) as per AASHTO T-104 |
| Sand Equivalence (S. Eq) | 45 (Min) as per AASHTO T-176 |
| Liquid Limit (L.L) | 25 (Max) as per AASHTO T-89 |
| Plasticity Index (P.I) | 4 (Max) as per AASHTO T- 90 |
| Flakiness Index (F I) | 10% (Max) |
| Elongation Index | 10% (Max) |

2.6.2.2. **Asphaltic Material.** Refer to Para 2.6.1.5. (Asphaltic material for Asphaltic Base Course).

2.6.2.3. **Asphaltic Concrete Wearing Course Mixture.** The composition of asphaltic concrete paving mixture for wearing course shall conform to Class-A and / or Class-B as shown in Table 2-30, ranging in thickness from 30 to 80 mm.

**TABLE 2 -30**
**Asphaltic Wearing Course Requirements**

| Combined Aggregate Grading Requirements | | | |
|---|---|---|---|
| Sieve Designation | | **Class-A (50-80** mm) Compacted Thickness | **Class-B (30-60 mm)** Compacted Thickness |
| **Mm** | **Inch** | **Percent Passing by Weight** | |
| 25 | 1 | 100 | - |
| 19 | 3/4 | 90-100 | 100 |
| 12.5 | 1/2 | - | 75-90 |
| 9.5 | 3/8 | 56-70 | 60-80 |
| 4.75 | No.4 | 35-50 | 40-60 |
| 2.38 | No. 8 | 23-35 | 20-40 |
| 1.18 | No. 16 | 5-12 | 5-15 |
| 0.075 | No.200 | 2-8 | 3-8 |
| Asphalt Content (% of total mix weight). | | 3.5 (Min). | 3.5 (Min). |

**Note: - Gradations** in Table 2-31 are for guidance only to prepare JMF

(1) **Marshall Criteria** of Asphaltic Wearing Course is shown in Table 2-31.

**TABLE 2 -31**

| | |
|---|---|
| Stability | 1000 Kg (Min) |
| % Air Voids in Max. | 4-7 |
| Loss of stability in 24 Hours | 20% (Max) |
| Flow, 0.25 mm (0.01 inch) | 8-14 |
| % Voids in Mineral Aggregate | According to Table 5.3 of MS-2 Asphalt Institute ($6^{th}$ Edition) |
| Compaction, No. of blows on each end of specimen | 75 |

(2) **JMF -Asphaltic Wearing Course (Plant Mix).**

(a) At least one week prior to production, the JMF shall be established by Marshall Method of Mix Design as per procedure described in the Asphalt Institute Manual Series No. 2 (MS-2) or as decided by the designer.

(b) The ratio of weight of Filler (Passing Sieve# 200) to that of Asphalt shall range between 1-1.5 for hot climate areas with temperature more than 40°C.

(c) After the JMF is established, all mixtures furnished for the project represented by samples taken from the asphalt plant during operation shall conform to following ranges of tolerances.

**TABLE 2 -32**
**Tolerances in Combined Aggregate Gradation and Asphalt Content**

| | |
|---|---|
| Retained # 4 & Larger Sieves | ±7.0% |
| Passing # 4 to 100 Sieves | ±4.0% |
| Passing # 200 Sieve | ± 1.0% |
| Asphalt Content | ±0.3% |

(d) Loss of Marshall Stability by immersion of specimen in water at 60°C for 24 hours as compared with the same for 20 minutes shall not exceeding 20%. In case of failure, the JMF shall be modified or an anti-stripping agent be used.

(e) A new JMF will be established subject to change of source of material, if any.

(f) Following specimen JMF for Aggregate Wearing Course, applicable to MES Schedule Item 02-83 has been given for estimation purposes. In case different mix formula is used, the rate shall be adjusted by deducting the cost of materials in the above formula and adding the material cost incorporated in the new JMF at "Material Supplied Only" rates as given in Section-28 of this Schedule of Rates.

i. Asphalt Cement grade 60 / 70 4.5%

ii. Stone dust (Khaka) 38.2%

iii. Aggregates 1/2" 33.40%
iv. Aggregates 3/4" 23.90%

(g) Density of Plant-mix Asphaltic Wearing Course be 2.355 T /cum.

**CONSTRUCTION REQUIREMENTS**

2.6.2.4. Table 2-33 shows the Construction Requirements of laying Asphaltic Wearing Course Material. Other requirements shall conform to the one specified for Asphaltic Concrete Base Course (Plant Mix.)

**TABLE 2 - 33**

| | |
|---|---|
| Minimum Compaction Requirement | 97% of Laboratory compacted specimen obtained from daily Marshall Density |
| Tolerance in Compacted Thickness | ±3mm |
| Coring Criteria | 1 Core / 100 M of each lane |
| Permissible variation of surface by straight edge | 5 mm (Max) |
| Cross fall / Camber | ±0.2% |

2.6.2.5. **Criteria for Rejection of Laid Asphalt.** When the compaction or density of core is less than 97%, or thickness of cores is deficient by more than 10 mm, the area will be considered as rejected.

2.6.2.6. **Price Adjustment for Asphalt Wearing Course.** If the thickness of cores is deficient by more than 3mm but not more than 10mm, payment will be made at an adjusted price as specified in Table 2-34, provided density achieved fulfills specified criteria.

**TABLE 2-34**

| Deficiency in Thickness as Determined by Cores | Proportional Rate of Schedule Price Allowed |
|---|---|
| 0.0 mm to 3.0 mm | 100% |
| 3.1 mm to 5.0 mm | 90% |
| 5.1 mm to 10.0 mm | 80% |

**Note: -Table** for reference only, final decision to be given by Engineer-in-Charge.

2.6.2.7. **Considerations for JMF Asphaltic Concrete**

(1) The Job Mix Formula (JMF) is to be prepared by Marshall Method. In order to develop proper Job Mix Design, DD&C or any other reputed laboratory shall be approached to select different gradation of materials, their blending conditions and performance criteria.

(2) The rates included in the Schedule are based on the above formula. In case different mix formula is used, the rates shall be adjusted by deducting the cost of materials in above formula and adding the material cost incorporated in the new JMF at "Material Supply only" rates of Section-28 given in the Schedule.

(3) Asphaltic plant, paver and allied equipment / T&P etc., being integral part of Weigh batched Asphaltic Concrete has been accounted for in rates of Schedule Item 02-82 & 02-83.

**2.7. Concrete Pavement.** It involves Rigid Pavement for Roads and Runways. The materials and construction requirements are described in Section 3 "Concrete". The detailed Technical instructions are given in TI No. R-9, "Rigid Construction procedures and quality control (Lean Concrete and PCC) for Runways".

**MATERIAL REQUIREMENTS**

2.7.1. Coarse Aggregates, Fine Aggregates, Cement and water shall conform to Material requirements given in Section 3 "Concrete".

**CONSTRUCTION REQUIREMENTS**

2.7.2. Following are the Construction requirements of Concrete pavement for Roads, Hard standings and Runways:-

2.7.3. **Formation**

2.7.3.1. Line, level and extent of formation shall be as shown on the drawings or as directed by the Engineer-in-Charge.

2.7.3.2. Quality of material and workmanship for earthwork formation and sub-grade shall conform to the applicable requirements, mentioned in Section-1 "Excavation and earthwork".

2.7.4. **Concrete Pavement**

2.7.4.1. Max Size Aggregate and its gradation shall be provided in the drawings, with relation to Pavement thickness. Similarly, strength and other requirements shall be as per drawing with reference to Section-3 "Concrete".

2.7.4.2. Provide sand cushion and / or bottoming as required. Where bottoming / Sub-base is specified, fill in interstices in the bottoming with sand.

2.7.4.3. Ensure that the surface over which the concrete is to be laid is finished to the required gradients, camber and super elevation.

2.7.4.4. Immediately before laying of concrete, wet the surface over which the concrete paving is to be laid or spread approved building paper over lapped 38 mm at the joints between the sheets.

2.7.4.5. Total design thickness of Concrete shall be laid in one layer, if not specified otherwise with care that no cold joint is made in one slab. The slabs shall be of the sizes as ordered by the Engineer-in-Charge and shall be laid in alternate bays. The form work shall be of steel as approved by the Engineer-in-Charge.

2.7.4.6. Composition and minimum strength of Concrete shall be as specified by the Designer, with reference to Section-3 "Concrete".

2.7.4.7. Form Expansion joints between the slabs to the full depth of the concrete. The expansion joints shall be 13 mm wide or as per drawings.

## 2.8. Rapid Runway Repairs

2.8.1. Pre-cast RCC slab (double reinforced top and bottom) 2 M x 2 M x 14 cm shall be laid / used for riding surface as shown in Figure 2-1 and Figure 2-2 The slabs shall have a 38mm x 38mm x 3mm angle iron fixed on all four sides, so that edges do not break in handling. Each slab shall have two holes for lifting.

2.8.2. Craters shall be cut in multiple of 2 M plus 6 cm, either side. These shall be filled and completed with a portion of debris and rock ballast, compacted and provided with a level surface stone chips upto 140 mm, below from top. Special leveling and slab lifting arrangement shall be provided. The RCC slabs shall be lifted 3-4 in numbers (maximum) at a time by means of a lifting beam attached to Front End loader having lifting hooks. The slabs after laying shall be rolled and joints filled with sand.

2.8.3. Where use of Quick Setting / Rapid Hardening Cement is required for Rapid Runway Repairs, approved admixtures shall be added to the cement at the ratio specified by the manufacturer.

## 2.9. Joint Sealants and Joint Fillers

### 2.9.1. Joint Sealant

2.9.1.1. Joint Sealant shall conform to specifications required vide ASTM - D 1850-74 or BS 5212, Types W, F and FB.

2.9.1.2. Thickness of sealant shall be as recommended by the Pavement Designer or min one (1.0) inch on top of joint filler.

2.9.1.3. Joint sealant shall be laid in place as recommended by the manufacturer and allowed to cure/harden for the time period recommended, before opening it for use.

### 2.9.2. Seal Coat Runway Sealant

2.9.2.1. Fuel Resistant Sealant constitutes a protective coal-tar emulsion with heavy paint consistency. It gives better appearance besides giving protective shield coating to old or new asphalt pavements which are under heavy traffic and experience fuel leakages. The sealer, in addition protects pavement from damage and deterioration caused by destructive sun-rays, oxidation, water penetration and frost.

2.9.2.2. The Runway sealant should preferably comply with specifications laid down in Table 2-35.

### 2.9.3. Joint Filler

2.9.3.1. The following types may be used as Joint filler:-

(1) Sand Asphalt cement Mixture.

(2) Joint fillers based on chemical compositions as recommended by the manufacturers of various brands available in the market along with necessary instructions.

2.9.3.2. In case of Sand-Asphalt cement Mixture, a stiff paste shall be prepared by mixing hot asphalt cement and coarse sand. The mixture shall be rammed in the expansion joint gap, so that no void/ open spaces are left in gap.

2.9.3.3. Top level of filler shall be dressed so as to leave appropriate space on top to receive Joint sealant as recommended by the manufacturer.

2.9.3.4. The work of Joint Filler and Joint Sealant shall be finished neatly as directed by the Engineer-in-Charge.

**TABLE 2 -35**

| | |
|---|---|
| Water | 47-53% |
| Non volatiles (solid contents) | 50-51.5% |
| Ash of Non volatiles | 30-40% |
| Solubility of non-volatiles in Carbon disulphide (CS2) | 20-47% |
| Specific Gravity @ 25° C | 1.0-1.25 |
| Drying time (hours) | 6-8 |
| Adhesion and resistance to Kerosene | No softening or loss of adhesion |
| Adhesion & resistance to Water | No blistering, loss of adhesion or re-emulsification |
| Resistance to heat | No blistering, sagging or slipping |
| Flexibility | No flaking, cracking or loss of adhesion |
| Resistance to impact | Not more than ¼, cracking or flaking. |
| Resistance to volatilization | 8-10 % |
| Wet film continuity | Uniformly smooth, non-granular, free from Coarse particles. |

**2.10. Asphalt Wearing Course for Run-ways and Taxi-way etc.** Design criteria for Asphalt Wearing Course will be governed by the Marshall Design Criteria and will be decided by the Designer.

**2.11. New Jersey Barrier.** The typical design of RCC pre-cast Jersey barrier of various sizes like 2'-6"/3'/3'-6" x 3' x 6' / New Jersey barrier cast in situ is shown in figure 2-3.

## METHOD OF MEASUREMENTS

**2.12. Measurement of Work.** Measurement of various items under this Section will be linear Meters (M), square meters (Sqm), cubic meter (Cum) and Tons. Details are as under:-

(1) Granular Sub-Base, WBM and Aggregate Base Course shall be measured in Cum based on the provision of drawings.

(2) Asphaltic Base Course and Asphaltic Wearing Course shall be measured in Tons. The Tonnage shall be established by multiplication of length, breadth and thickness (L x Bx T). The thickness will be determined by Asphalt cores in laid / compacted asphaltic layer. Unit weight will be taken as established by JMF.

(3) Generally, the limits of measurements for above items shall be as per drawings or as approved by the Engineer-in-Charge.

(4) **Measurement of Bit-mac**

(a) Unless otherwise shown on the plans or as directed by the Engineer-in-Charge, quantity of Bit-mac shall be measured by theoretical volume of compacted mix in place, in Cum.

(b) No measurement will be made for unauthorized areas or for extra thickness than specified. Minimum quantity for pot hole shall be 0.05 cum.

### 2.13. Measurements for Road Materials

2.13.1. Sand, crushed / broken stones or the like, shall be measured net when in measurement box at the site of work.

2.13.2. In measuring stacked sand, crushed/ broken stones or the like, a deduction of one-twelfth ($1112^{th}$) shall be made from the measured quantity to allow for unevenness in ground, loose stacking etc.

2.13.3. Boulders and quarried stone for road metc1I will be measured after breaking as in Para 2.12.2 above. Boulders and quarried stone for bottoming shall be measured net after incorporation in the work. Where either of the above methods of measurements of boulders and quarried stone is impracticable, these materials shall be stacked in tightly packed stacks, not less than one meter in height and a deduction of 15% made from Gross measurements to allow for voids. ,

2.13.4. All 'carpeting' material for either new work or repairs shall be stacked in regular heaps and measurement of same taken before spreading.

2.13.5 All the Asphaltic Concrete / Bit-Mac measurement shall be as per Prime /Tack coat.

## CLARIFICATION OF RATES

**2.14.** The rates, inter alia, include particularly:-

(1) Rolling including compaction of small area inaccessible to a roller, with Hand Guided Roller, Plate Compactor or Jumping Vibrator or with iron rammers (if allowed).

(2) Pot-holes, each exceeding one Sqm shall be paid for as new work under the relevant item.

(3) Formation surfaces and bottoming /Sub base for Concrete surfaces be paid for separately under relevant rates in this section.

(4) Wetting surfaces before laying Concrete in roads, hard standings and Runways etc.

(5) Forming Expansion joints to be paid extra.

(6) Pre-cast RCC slabs and equipment for lifting and placing of slabs for Rapid Runway Repairs shall be supplied by the Engineer-in-Charge. Carriage upto 3 Km is included in the rates specified. Extra carriage if required shall be paid separately.

(7) Compaction, if not mentioned, shall be to the specified percentage of AASHTO density or as for the item of work in this Schedule of Rates.

(8) For Bit-mac, the accepted quantities measured above shall be paid at the MES Schedule of Rates, which price and payment shall constitute full compensation for furnishing all materials, hauling, placing, rolling, labour, equipment, tools and incidentals necessary to complete the item.

(9) The concrete having 28 days minimum cylinder compressive strength 3000 psi, 4000 psi etc. and PQC 600 psi flexural strength include weigh batching plant, concrete pump, vibrators and other vehicles for loading/ transportation upto 10 Km lead and placing of dowel etc.

Drawing # CEP 2860

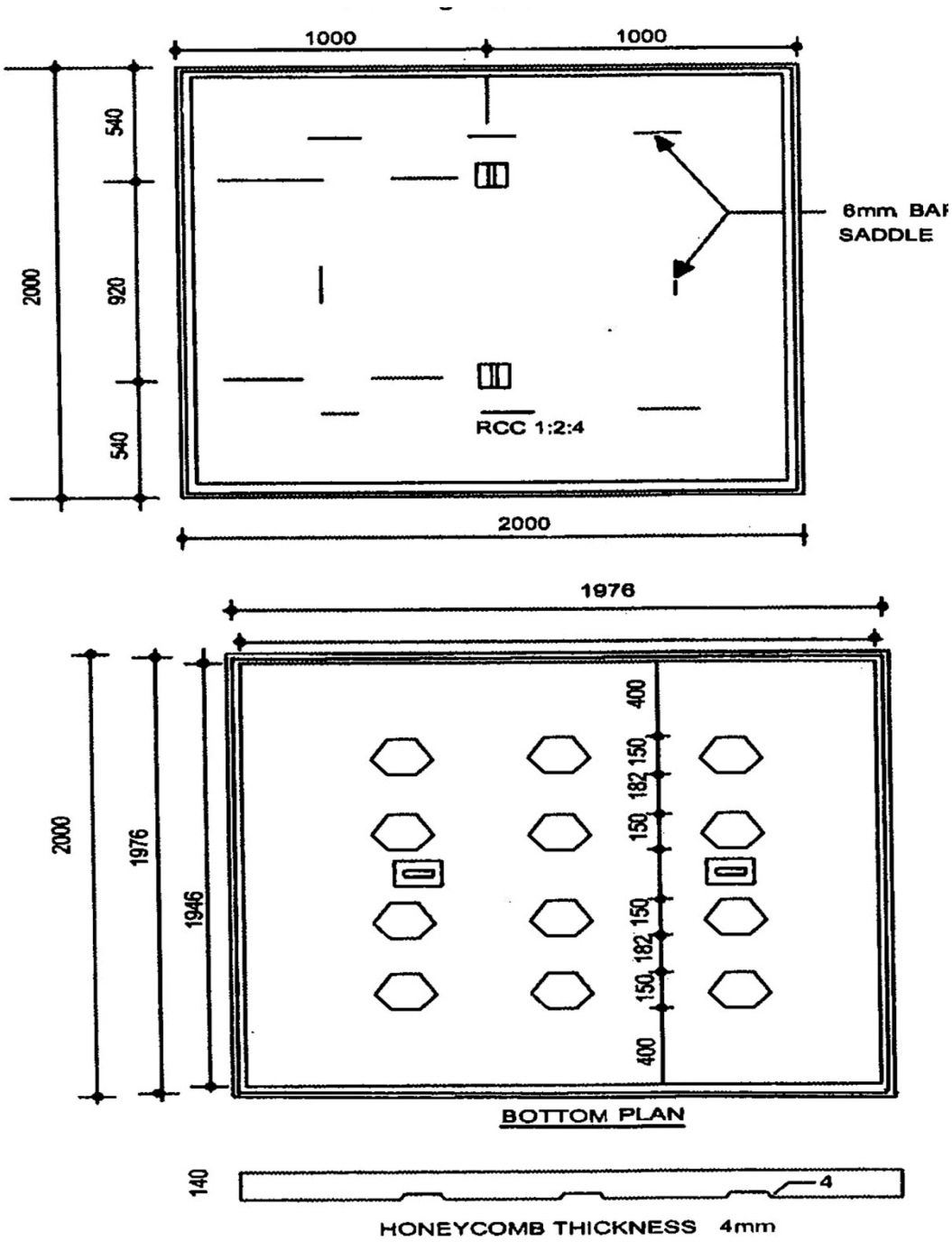
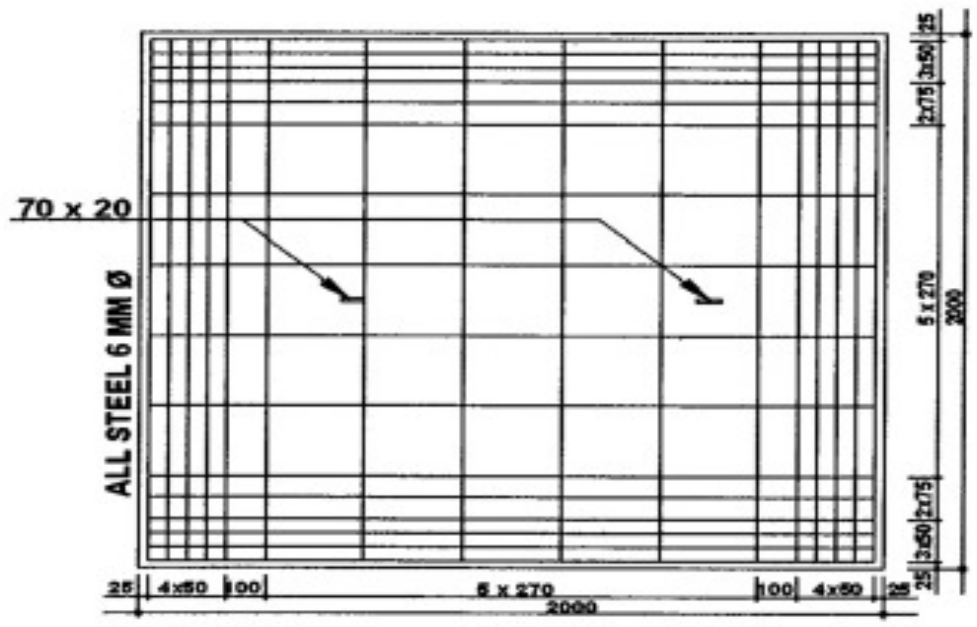
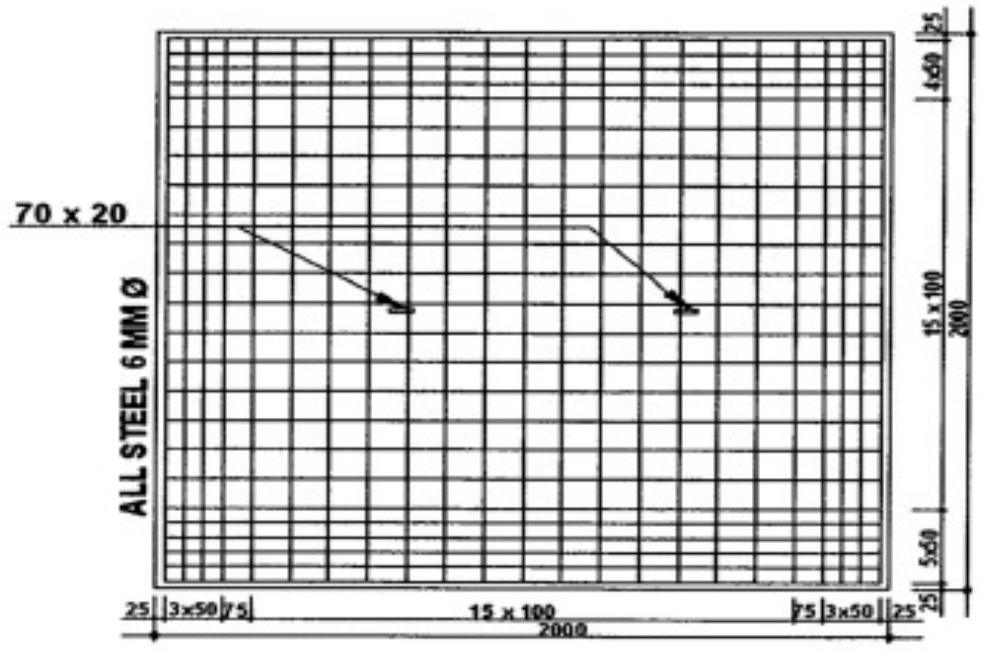



*FIGURE 2-1: RCC SLAB FOR RAPID RUNWAY REPAIRS*

*(Not to Scale)*



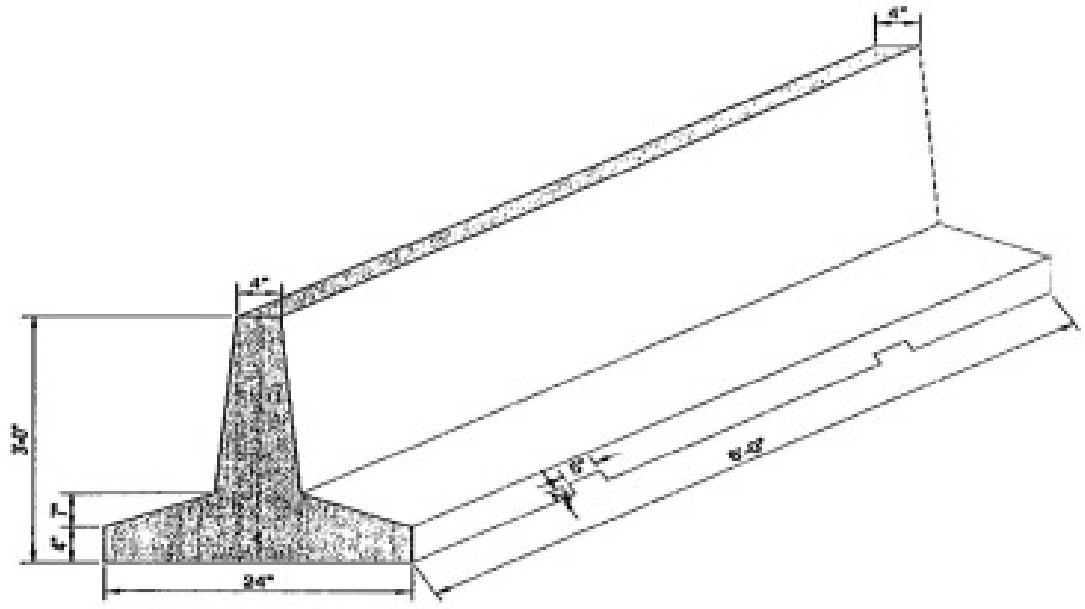

**TOP MAT - STEEL**



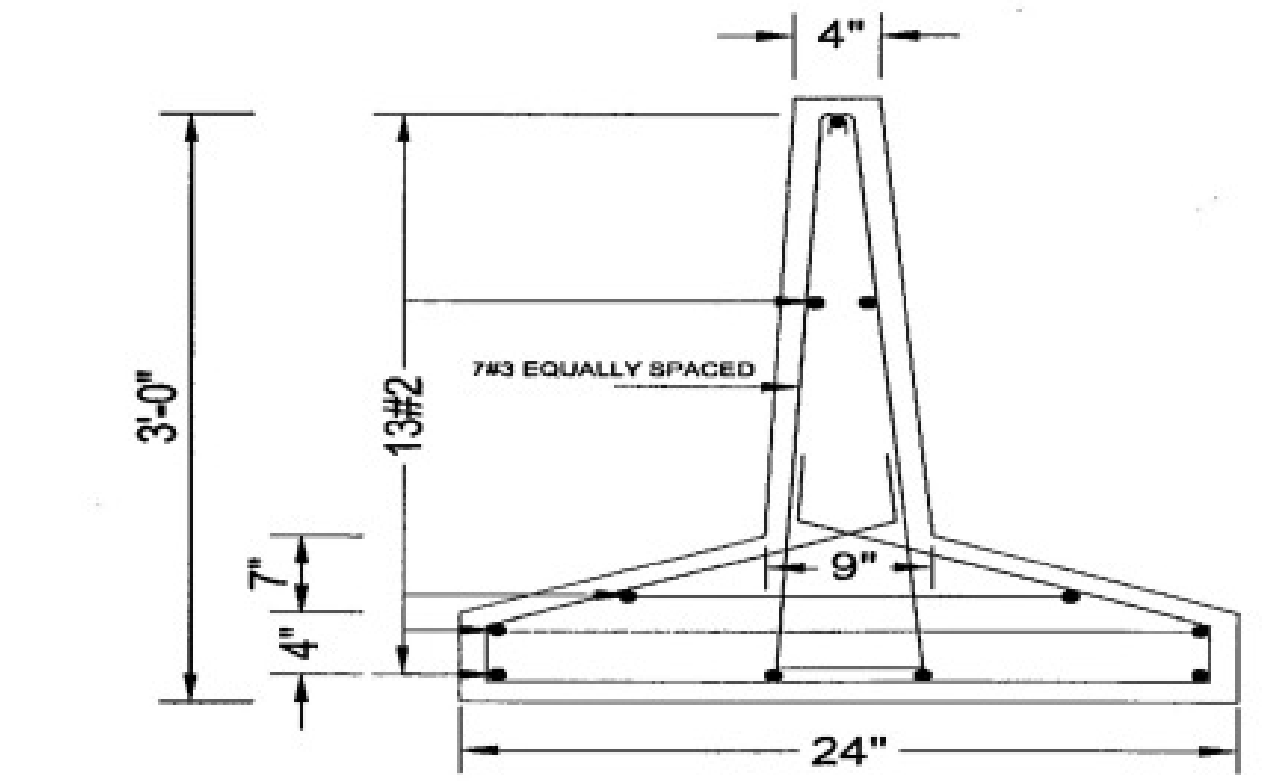

**BOTTOM MAT - STEEL**

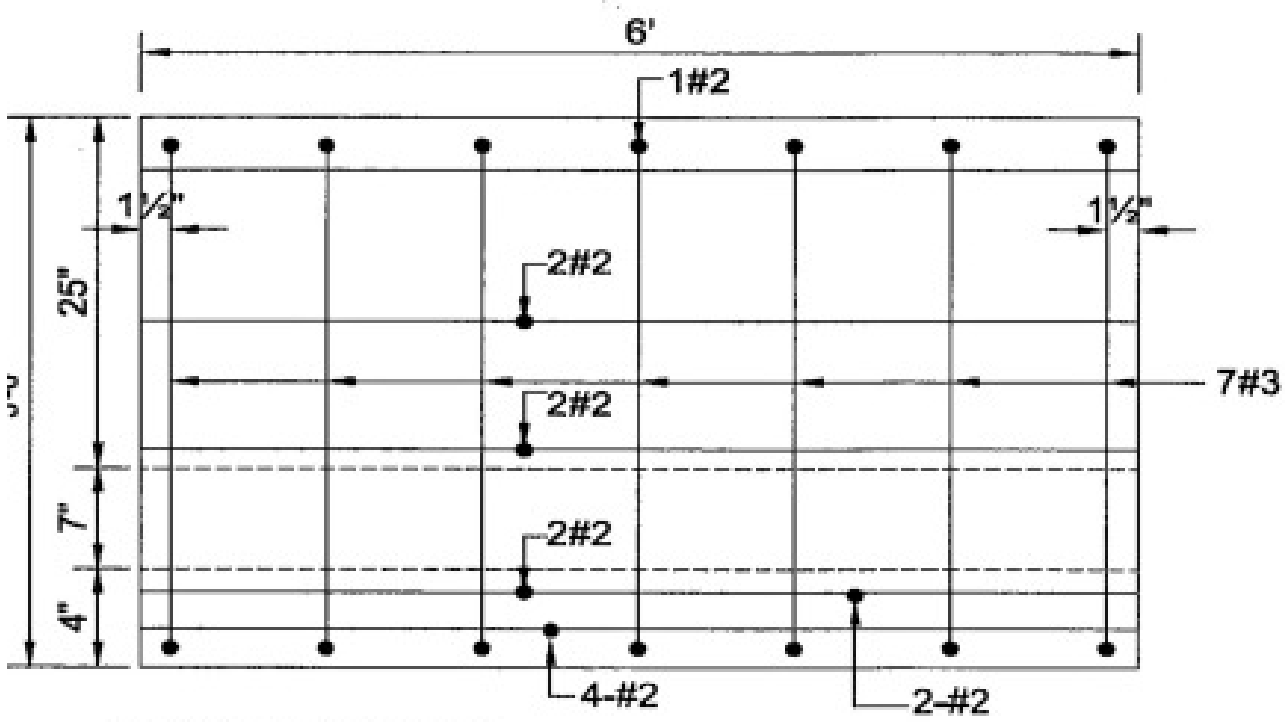
**FIGURE : 2-2**

**(Not to Scale)**



PRE-COST RCC JERSERY BARRIER




SIDE ELEVATION

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Collection of Materials** | | |
| 2-1 | **Collection of sand, and crushed stones** within a radius of 25 M and stacking to template (1112th to be deducted from measured quantum of stack). | Cum | **422** |
| 2-2 | **Screening of crushed stones** as directed and stacking to template (Measurement to be taken before screening) Using one screen. | Cum | 289 |
| | **Cut or Fill** | | |
| 2-3 | **Cut or fill in Granular Soil** not exceeding 150 mm, compact formation surface by compacting equipment and roller upto 100% Modified MSHTO density, including filling in depression with hard soil. | Sqm | 12 |
| 2-4 | Same as item 02-03, but 95% Modified MSHTO density. | Sqm | 12 |
| 2-5 | Same as item 02-03, but 90% Modified MSHTO density. | Sqm | 11 |
| 2-6 | **Cut or fill in soft or hard soil** not exceeding 150 mm, dry roll and compact formation surface by power roller including filling in depression with hard soil. | Sqm | 11 |
| | **Compaction** | | |
| 2-7 | **Roll and compact, Granular Soil** formation surface / embankments upto 150 mm layers, by compaction equipment and roller upto 100% Modified MSHTO density, including filling in depression with hard soil. | Cum | 77 |
| | **Roll and compact, Cohesive. Soil** formation surfaces/embankments upto 150 mm layer, by compaction equipment and roller upto 95% Modified MSHTO density, including filling in depression with hard soil. | Cum | 75 |
| 2-9 | Same as item No. 02-8, but 90% Modified MSHTO density. | Cum | 71 |
| 2-10 | **Roll and compact, Formation Surface,** embankment upto 150 mm layers, by roller, including filling in depression, with hard soil. | Cum | 71 |
| | **Bottoming /Sub Base** | | |
| 2-11 | **Bottoming /sub base** of any thickness as specified using **Soil Aggregates of CBR 30%,** laid and compacted to 100% Modified MSHTO density by appropriate compaction equipment and roller. | Cum | 2551 |
| 2-12 | Same as item 2-11 but with **Granular Sub Base material,** all as specified. | Cum | 2714 |
| 2-13 | **Bottoming /sub base** of any thickness as specified using **Soil Aggregates of CBR 30%,** compacted, including rolling by appropriate compaction equipment and roller and filling in depression. | Cum | 2399 |
| | **Base Course** | | |
| 2-14 | **Water Bound Macadam (WBM),** Base Course of CBR 100%, any thickness as specified, laid and compacted to 100% Modified MSHTO density by appropriate compaction equipment and roller. | Cum | 3146 |
| 2-15 | **Aggregate Base Course,** of any thickness as specified, laid and compacted to 100% Modified MSHTO density, by appropriate compaction equipment and roller. | Cum | 2840 |
| 2-16 | **WBM,** of any thickness as specified, including rolling, compacting, filling in depression and watering during rolling. | Cum | 2374 |
| | **Hot Surface Treatment** | | |
| 2-17 | **Hot Surface Dressing, Two Coat work, on WBM** surface, not previously treated with Hot Dressing, using **Broken or Crushed stone,** all as specified. | Sqm | 572 |
| 2-18 | Same as item 2-17 but, **Three Coat work, all as specified.** | Sqm | 702 |
| | **Repairs** | | |
| 2-19 | **Scarifying WBM surface,** by hand or by power, not exceeding 50 mm deep including removing not exceeding 50 Mand stacking for re-use. | Sqm | 30 |
| 2-20 | Add to item 02-19, for every 25 mm or part thereof beyond 50 mm deep including removing not exceeding 50 Mand stacking for re-use. | Sqm | 15 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 2-21 | **Repair Pot-holes** not exceeding one sqm each in surface of roads by scarifying surfaces, cutting edges at least 25 mm deep, sweeping free from dust and mud, coating surface with **Hot Dressing** and filling with premix of crushed stones, asphalt bitumen, and ramming it well. | Sqm | 724 |
| 2-22 | Same as item 2-21 but by using with **Asphalt cement,** all as specified. | Sqm | 741 |
| | **Premix Carpet (Bit-Mac) On Asphaltic Surface** | | |
| 2-23 | Providing and laying **Premix Carpet of any thickness,** compacted on asphaltic surface, as specified, using asphalt cement 60/70 or 80/100 and **Broken** / **Crushed stone** including tack coat. | Cum | 21410 |
| | **Premix Carpet (Bit-Mac) On WBM Surface** | | |
| 2-24 | Providing and laying, **Premix carpet of any thickness,** compacted on WBM surface, as specified, using asphalt cement 60/70 or 80/100 and **Broken or Crushed stone,** including prime coat. | Cum | 22996 |
| | **Asphaltic Courses (Plant Mix)** | | |
| 2-25 | Providing and laying, **Asphaltic Base Course** of any thickness, as specified, with asphalt cement 60/70 or 80/100 **using JMF** (except prime coat). | Ton | 7485 |
| 2-26 | Providing and laying, **Asphaltic Wearing Course** of any thickness, as specified, with asphalt cement 60/70 or 80/100, using **JMF** (except tack coat). | Ton | 8044 |
| | **Prime Coat** / **Tack Coat** / **Seal Coat** | | |
| 2-27 | **Prime Coat,** on Base Course surface. | Sqm | 144 |
| 2-28 | **Tack Coat,** on asphaltic surface. | Sqm | 77 |
| 2-29 | Providing and laying **Seal Coat** using sand and asphalt cement, all as specified. | Sqm | 170 |
| | **Concrete - Roads, Hard Standings and Runways etc.** | | |
| 2-30 | Providing and laying **PCC with 4000 psi compressive cylindrical strength** all as specified in slabs for roads, hard standings, etc., of any thickness, using Crushed stone, including use and waste of form work (steel) and finishing surface even and fair (not smooth). | Cum | 13735 |
| 2-31 | Same as item 02-30, but **PCC with 3000 psi compressive cylindrical strength** all as specified. | Cum | 11845 |
| 2-32 | Providing **Sand Cushion** in layers as specified, under concrete roads, hard standings and Runways etc. | Cum | 1231 |
| 2-33 | Providing and Laying **PQC Flexural Strength of 600 psi for Runway, Taxiway** Links, Lead-ins and Tarmac of any thickness using Concrete Mix Design laid Manually all as specified. | Cum | 17435 |
| 2-34 | Same as 2-33 but laid with fixed-form, mechanical paver, all as Specified. | Cum | 22064 |
| 2-35 | Same as 2-33 but laid with slip-form, mechanical paver, all as Specified. | Cum | 26661 |
| | **Wire Mattresses** | | |
| 2-36 | Supply No 8 SWG, GI wire made up into mattress 100 x100 mm mesh, fix and bind with 14 SWG wire (mattresses and laps measured). | Sqm | 979 |
| 2-37 | Same as item 02-36 but mattress 150 x 150 mm mesh. | Sqm | 799 |
| | **Rapid Runway Repair** | | |
| 2-38 | Lifting and placing of pre-cast RCC slabs, with a special lifting beam including carriage as required, for Rapid Runway Repairs. | Sqm | 772 |
| 2-39 | Filling **Sand** between joints (3-6 mm thick) of pre-cast RCC slabs for Rapid Runway Repairs and rolling with 6-8 ton roller to make the surface perfectly level with adjacent surface. | Sqm | 15 |
| | **Expansion Joints** | | |
| 2-40 | Labour and necessary material for forming of **Expansion joint 13 mm wide** and leaving the joint clear for filling (length of joint multiplied by thickness of joint). The filling of the joint with requisite filler will be carried out by the specialists. | Sqm | 448 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 2-41 | Providing and fixing, **Expansion Cap 25 mm to 40 mm dia** for movement of dowels all as specified. | Each | 306 |
| | **Speed Breakers / Studs** | | |
| 2-42 | Providing and fixing **Road speed Breaker** with reflectorized plastic, 350 mm wide and 50 mm high including end pieces both sides complete with Bolts and plugs. | Metre | 10530 |
| 2-43 | Same as 2-42 but with reflectorized EPM **Rubber,** all as specified. | Metre | 8130 |
| 2-44 | Same as 2-42 but with reflectorized **Metal,** all as specified. | Metre | 16530 |
| 2-45 | Reflectorized **Plastic Pavement Stud** (10cm x 7.5 cm x 2 cm), Raised type. | Each | 462 |
| 2-46 | Same as 2-45 but having size (10 cm x 20 cm x 2 cm), Flush type. | Each | 726 |
| 2-47 | Same as 2-45 but **Aluminum.** | Each | 834 |
| | **Jersey Barriers** | | |
| **2-48** | Supply and Fix **RCC pre-cast jersey barrier** including lifting and erection, all as specified. | Metre | 8793 |
| 2-49 | Providing and laying **new jersey barrier (PCC 4000 Psi),** cast in situ with slip form paver, all as specified. | Metre | 4517 |

# SECTION-3

# CONCRETE

# REeORB OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION -3

# CONCRETE

## SPECIFICATIONS

**3.0.** This section covers following:-

(1) Classification of Concrete
(2) Material Requirements
(3) Construction Requirements for materials, mixing, handling, placing, curing and testing etc.
(4) Concrete Blocks (Solid/ Hollow), Kerb-Stones etc.

**3.1.** All Concrete works shall be carried out in accordance with the applicable requirements of ACI / ASTM / BS Standards as approved by Engineer in Charge before commencement of works.

**3.2. Classification of Concrete.** In order to meet the strength and durability requirements, the concrete is classified into **Structural Concrete and Non-Structural Concrete.** The use and characteristics are given as follows:-

3.2.1 **Non-Structural Concrete.** It shall be used as lean, underfloor layers, and hard standings etc. or as described in drawings having compressive strength upto 1500 psi. It is prepared by using cement and other basic ingredients, i.e. Coarse aggregates, Fine aggregates and Water. Frequently used mix proportions are 1:6:12, 1:4:8 1:3:6 and 1:2:4. The proportions mentioned for non-structural concrete are by volume. A cement bag of 50 Kg, forms a unit of 0.035 Cum- (Gauge box of 30cm x 30cm x 39cm). The Engineer in Charge shall ensure preparation of the Mix proportions or as specified for non-structural elements, based on the availability of local materials.

3.2.2. **Structural Concrete.** It shall be used in structural members like foundations, columns, lintels, beams and roof slabs etc. The strength of concrete will be specified in terms of minimum 28 days estimated cylindrical strength equal or more than 3000 psi, 3500 psi, 4000 psi, 5000 psi and 6000 psi. For a specified design strength, it is mandatory to get the Concrete Mix Design, prescribing exact quantities of Cement, Coarse and Fine aggregates with their size / gradation, water cement ratio and slump. It is recommended to get the **Concrete Mix Design** designed from a Consultant or DD&C (Engineer-in-Chiefs Branch). In case the **Mix Design** is prepared by any other private consultant or designer, the use of this Concrete will be in accordance with the instructions by the concerned Consultant / Designer or may be vetted by DD&C, where mentioned and, it shall be vetted by the concerned Designer and include some or all of the following:-

(1) Max water cement ratio
(2) Min cement content
(3) Air content (if required)
(4) Slump
(5) Max Size of aggregate
(6) Min Strength
(7) Other requirements relating to strength, durability, admixtures and special type of cement.

3.2.3. The typical gradations for different compressive strengths are given in "Supplementary Instruction for MES Schedule of Rates-2021". In case of any variation in the materials based on the Mix Design, approved by the Engineer in Charge, the rates be derived on proportionate basis using cost of materials given in Material Supply Only (Section-28) and adjusted accordingly.

## MATERIAL REQUIREMENT

**3.3. Cement.** Various types of Cement commonly used in Concrete works are given in Table 3-1.

3.3.1 Cement shall conform to the specifications for Portland Cement ASTM C-150 / BS-12, unless otherwise specified to be of any particular quality, shall mean Ordinary Portland Cement.

**TABLE 3-1**
**Types of Cement**

| Type | Use |
|---|---|
| I | **Ordinary Portland Cement;** General purpose cement, when there are no extenuating conditions |
| II | **Modified Cement;** Aids in providing moderate resistance to Sulphate attack |
| 111 | **Rapid Hardening Cement;** When high-early strength is require |
| **IV** | **Low Heat Cement;** When low heat of hydration is desired (in massive structures) |
| V | **Sulphate Resistant Cement;** When high Sulphate resistance is required. |
| **IA** | Type I Cement, containing an integral air-entraining agent |
| II **A** | Type II Cement, containing an integral air-entraining agent |
| III A | Type III Cement, containing an integral air-entraining agent |

3.3.2. Where Sulphate resistant cement is required, soil tests for chloride content must be conducted. Table 3-2 (ACI 318-11) suggests that if chloride content exceeds the permissible limit then sulphate resistant cement must not be used and Slag cement ASTM C-989 is recommended in this case.

**TABLE 3-2**
**Requirements for Concrete by Exposure Class**

| Exposure Class | Max W/C* | Min fc• (psi) | Additional Minimum Requirements | | | |
|---|---|---|---|---|---|---|
| | | | Air content | | | Limits on Cementitious materials |
| FO | N/A | 2500 | N/A | | | N/A |
| F1 | 0.45 | 4500 | Table 4.4.1 | | | N/A |
| F2 | 0.45 | 4500 | Table 4.4.1 | | | N/A |
| F3 | 0.45 | 4500 | Table 4.4.1 | | | Table 4.4.2 |
| | | | Cementitious materials ' -types | | | Calcium chloride admixture |
| | | | ASTM C150 | ASTM C595 | ASTM C1157 | |
| SO | N/A | 2500 | No Type restriction | No Type restriction | No Type restriction | No restriction |
| S1 | 0.50 | 4000 | IIt | IP (MS). IS (<70) (MS) | MS | No restriction |
| S2 | 0.45 | 4500 | V§ | IP (HS) IS (<70) (HS) | HS | Not permitted |
| S3 | 0.45 | 4500 | V + pozzolan or slag | IP (HS) + pozzolan or slag or IS (<70) (HS) + pozzolan or slag• | HS + pozzolan or slag | Not permitted |
| | | | | | | |
| Po | N/A | 2500 | None | | | |
| P1 | 0.50 | 4000 | None | | | |
| | | | Maximum water-soluble chloride ion (CI'') content in concrete. (Percent bv weii ht of cement)# | | Related provisions | |
| | | | Reinforced concrete | Prestressed concrete | | |
| Co | N/A | 2500 | 1.00 | 0.06 | None. | |
| C1 | N/A | 2500 | 0.30 | 0.06 | | |
| C2 | 0.40 | 5000 | 0.15 | 0.06 | 7.7.6 18.16 | |

•For lightweight concrete, see 4.1.2.

r Alternative combinations of cementitious materials of those listed in Table 4.3.1 shall be permitted when tested for sulfate resistance and meeting the criteria in 4.5.1.

: For seawater exposure, other types of Portland cements with tricalcium aluminate (C A) contents up to percent are permitted is the wicm does not exceed 0.40.

9 Other available types of cement such as Type Ill of Type I are permitted in Exposure Classes S1 of S2 if the CJA,. contents are less than 8 or 5 percent, respectively.

The amount of the specific source of the pozzolan or slag to be used shall not sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan of slag to be used shall not be less than the amount tested in accordance with ASTM C1020 and meeting the criteria in 4.5.1.

•water-soluble chloride ion content that is contributed from the ingredients including water, aggregates, cementitious materials and admixtures shall be determined on the concrete mixture by ASTM C1218 at age between 28 and 42 days.

.. Requirements of 7.7.6 **&hat!** be satisfied.

3.3.3 **Where** Sulphate Resistant Cement is ordered and used, it shall be Sulphate Resistant Portland Cement of the approved make fully conforming to ASTM C - 150 / BSS 4027. The relevant rate for payment shall be increased by the ratio of increase in the rates of Sulphate Resistant Cement over Ordinary Portland Cement only. For selection of a particular type of Sulphate Resistant Cement, Table 3-3 given below may be used as a guide, for approval by the Designer or the Engineer-in-Charge in prevalent sulphate environment, prior to commencement of work.

(1) Super-sulphate cement may also be used to avert sulphate attack. It is made by inter grinding a mixture of 80 -85 % granulated blast-furnace slag with 10-15% calcium sulphate (burnt gypsum) and about 5% of portland cement clinker. It is highly resistant to seawater and can withstand the highest concentrations of sulphates normally found in soil or groundwater.

(2) Steel reinforcement in concrete is protected by its alkaline nature. Corrosion takes place only when pH value of concrete is reduced due to exposure to oxygen or oxidizing salts. This is accelerated by increase in permeability of concrete due to cracking and carbonation.

(3) If concentration of chlorides in reinforced concrete exceeds the minimum threshold, the steel may be protected by galvanizing, coating with epoxy, increasing concrete cover and cathodic protection.

**TABLE 3-3**
**Recommended Types of Cements for Severity of Sulfate Attack**

| Exposure | Concentration of Soluble Sulphates (SO4) | | |
|---|---|---|---|
| | In Soil(%) | In Water (ppm) | Cement Type |
| **Mild** | < 0.1 | < 150 | Any Type |
| **Moderate** | 0.1 to 0.2 | 150 to 1500 | Type II or Type I blended* |
| **Severe** | 0.2 to 2.0 | 1500 to 10000 | TypeV |
| **Very Severe** | > 2.0 | > 10000 | Type V blended* |

* Cement may be blended with Pozzolana (25 - 40%), or Blast Furnace Slag ( 70%) of types proven to improve Sulphate resistance.

## 3.4. Aggregates

3.4.1. Aggregate shall conform to the "Specifications for Concrete Aggregates" (ASTM - C 33). All Fine and Coarse aggregates to be used shall be supplied from an approved source, which shall not be changed without prior written permission of the Engineer in Charge. -

3.4.2. Aggregates must be clean, inert, hard, non-porous and free from dust, laminated particles, loam, clay, organic or other impurities and silt. Coarse aggregates shall be hard and durable broken / crushed stone or gravel.

3.4.3. **Fine Aggregate.** The Fine aggregate shall be non-plastic material and shall consist of sand, stone screenings or other approved inert materials with simiiar characteristics or a combination thereof and shall not contain more than 3% of material passing Sieve # 200 by washing and not more than 1% of clay lumps or shale. The Fine aggregate shall be_uniformly graded and when tested as per ASTM C-117 & C-136, shall meet gradation requirements given in Table 3-4:-

**TABLE 3-4**
**Grading- Fine Aggregate**

| Sieve Designation | Percentage Passing by Weight |
|---|---|
| 9.52 mm (3/8") | 100 |
| No. 4 | 95-100 |
| No. 8 | 80 - 100 |
| No. 16 | 50-85 |
| No. 30 | 25-60 |
| No. 50 | 5-30 |
| No. 100 | 0 -10 |

3.4.4. **Coarse Aggregate.** It shall consist of crushed or broken stone, gravel or other approved inert material with similar characteristics or a combination.

3.4.4.1. **Grading.** It shall be of uniform grading with maximum size as required for various types / classes of concrete meeting the grading requirements, when tested in accordance with ASTM C 117 & C 136, as given in Table 3-5.

**TABLE 3-5**
**Grading- Coarse Aggregate**

| Designation | | % a e by weight passing Laboratory sieves with square openings mm (in) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sizes | | | | | | | | | |
| mm | In | 63 (2½) | 50 {2) | 38 (1½) | 25 (1) | 19 (¾) | 13 (½) | 9 (%) | #4 |
| 13mm to #4 | ½"to# 4 | - | - | - | - | 100 | 90-100 | 40-70 | 0-15* |
| 19mm to #4 | ¾" to # 4 | - | | - | 100 | 90-100 | - | 20-55 | 0-10* |
| 25mm to#4 | 1" to #4 | - | | 100 | 95-100 | - | 25-60 | - | 0-10* |
| 38mm to# 4 | 1½"to # 4 | - | 100 | 95-100 | - | 35-70 | - | 10-30 | 0-5 |
| 50mm to#4 | 2" to #4 | 100 | 90· 100 | - | 35-70 | - | 10-30 | - | 0-5 |
| 38mm to 19mm | 1½"to¾" | - | ·,OO | 90-100 | 20-55 | 0-15 | - | 0-5 | - |
| 50 mm to 25 mm | 2" to 1" | 100 | 90-100 | 35-70 | 0-15 | - | 0-5 | - | - |

•Not more than 5% shall pass Sieve # 8

3.4.4.2. Other Properties of Aggregates

| Los Any les Abrasion Value | Lo s of weight when immersed in Na2So4 | Weight of material passing # 200 sieve by washing |
|---|---|---|
| 40% (max) as per ASTM C 131 | 12% (max) as per AASHTO T-104 | One (1)_% (max) |

### 3.5. Water

3.5.1. The quality of mixing water shall be determined by ASTM-C 1602 and ASTM-C 1603. Water used in Concrete shall be clean and free form injurious amount of acids, alkalis, salts, organic material or substances deleterious to concrete or reinforcement.

3.5.2. Water for curing, washing aggregates and mixing shall be free from oil and shall not contain more than 1,000 ppm of Chlorides, nor more than 150 ppm of Sulphates (SO4).

**3.6. Admixtures.** Admixtures shall only be allowed for use with written permission of the Engineer-in-Charge. This will be treated as an additional item and would be used as per manufacturer's instructions.

3.6.1. **Types.** An admixture can be defined as a chemical product which, except in special cases, is added to concrete mix in quantities not more than 5% by mass of cement during mixing or during an additional mixing operation prior to the placing of concrete, for the purpose of achieving a specific modification, to normal properties of concrete. Admixtures may be organic or inorganic in composition, but their chemical character as distinct from mineral, is their essential feature. Admixtures are commonly classified by their function in concrete. The classification as per ASTM C - 494 is as follows:-

| | |
|---|---|
| Type A | Water-reducing |
| Type B | Retarding |
| Type C | Accelerating |
| Type D | Water-reducing and retarding |
| Type E | Water-reducing and accelerating |
| Type F | High Range, water-reducing or super plasticizing |
| Type G | High Range, water-reducing and retarding or super-plasticizing and retarding |

3.6.2. The British Standards for Admixtures are BS 5075, Part 1, deals with accelerating, retarding, and water-reducing admixtures, and BS 5075, Part 3, (super-plasticizers), now superseded by European Standard EN 934-2, where available.

3.6.3 In practice, admixtures are marketed as proprietary products whose promotional literature sometimes includes claims of varied and wide-ranging benefits. Hence, it is important to understand specific effects of admixtures before they are used. Moreover, ASTM C 494 points out that the specific effects produced may vary with the properties and proportions of other ingredients of the mix. It is recommended that any type of admixture be used after considering the history of results and on the specific instructions of the Designer / Engineer -in- Charge. Incorporation of or replacing a part of cement by a pozzolanic material reduces the sulphate attack. Admixing of Pozzolana converts the leachable calcium hydroxide into non-leachable cementitious product. This pozzolanic action is responsible for impermeability of concrete.

3.6.4 Cristalproof Admix is a dry powder, which is added directly to the wet mix concrete during batching. Dosage rate is 2% by weight of cement (1kg / 50kg bag of cement). In order to overcome leakage and seepage issues, it can be used in foundations with high water table, basement retaining walls, underground / overhead water tanks, sunken slab area of washrooms, top roof slab for waterproofing, swimming pools, water ducts, tunnels and sewerage treatments plants. The chemical can also be used as a dry shake at the rate of 1 Kg per $m^2$ to the surface area of freshly laid concrete with a trowel finish.

**3.7. Reinforced Concrete.** The materials for Concrete shall conform to the requirements as mentioned above. The reinforcement shall be provided as per the design. The material for reinforcement shall conform to the specifications given in Section-9 (Steel and Iron works).

## CONSTRUCTION REQUIREMENTS

### 3.8. Materials

3.8.1. **Aggregate.** Maximum Size of Aggregate to be selected for use in various types of construction is given in Table 3-6. This shall be used in light of the provisions made above. However, the gradation shall be adopted as per Material Requirements highlighted in Para 3.4 above.

**TABLE 3-6**
**Selection of Max Size of Aggregate**

| Type of Construction | Max Size of Aggregate | |
|---|---|---|
| | mm | in |
| Plain Footings, caissons and Sub structure walls | 50 | 2 |
| Reinforced Foundation Walls and footings | 37.5 | 1-1/2 |
| Beams and Reinforced walls | 25 | 1 |
| Columns | 25 | 1 |
| Pavements and Slabs | 19 | 3/4 |
| Mass Concrete | >50 | 2 |

**Note** The Max Size of Aggregate is subject to condition that Concrete shall not contain any aggregate greater in size than 1/5 of the narrowest dimension between sides of the forms, nor 1/3 of the least dimension of the concrete nor 3/4 of the minimum clear spacing between the individual reinforcing bars or wires, bundles of bars, individual tendons, bundled tendons or ducts.

3.8.2. **General Characteristics of Aggregate**

3.8.2.1. Coarse aggregates shall be crushed aggregate from approved sources and conform to quality requirements mentioned in Para 3.4 of this Section. If allowed for a specific work, ballast, gravel may be used, mixed with sand to various proportions. However, these materials must conform to strength and gradation requirements, approved by Engineer-in Charge.

3.8.2.2. **Alternative aggregates of** broken CC will **NOT** be used in RCC in any position.

3.8.2.3. **Natural aggregates** shall be clean, round and smooth; where available ballast or gravel will be given preference.

3.8.2.4 Mixed aggregates are not required to be uniformly graded and shall be known as **Mixed Aggregate.** The size shall be specified in terms of the largest gauge required, but not exceeding 50 mm and shall consist of various gauges to correspond to the sample approved by Engineer-in-Charge.

**3.9. Water-Cement Ratio.** As per Building code, water cement ratio should be limited to **0.5 for Moderate Exposure** and less than **0.45 for More severe Exposures.** To place and compact such a dry mix, use of plasticizer is very important. Compressive cylindrical strength of concrete should not be less than 4000 psi for moderate exposure and 4500 psi for more severe exposures. The Compressive Cylindrical Strength of concrete should not be less than **4000 psi for Moderate Exposure and 4500 psi for more Severe exposures or** it shall be as specified in the design. Depending on the purpose of use, the recommended Slump for Concrete is selected from Table 3-7.

**TABLE 3-7**

**Recommended slumps for various types of construction**

| Type of Construction | Slump mm | |
|---|---|---|
| | Max* | Min |
| Reinforced Foundation Walls and footings | 75 | 25 |
| Plain Footings,caiss0ns and Sub structure walls | 75 | 25 |
| Beams and Reinforced walls | 100 | 25 |
| Building Columns | 100 | 25 |
| Pavements and Slabs | 75 | 25 |
| Mass Concrete | 75 | 25 |

**Note:-** *May be increased by 25 mm for methods of consolidation other than vibration

3.9.1 Low permeability or water-tightness is the key to good concrete. The mix should be properly proportioned to achieve minimum porosity. Concrete should be properly consolidated and cured.

**3.10. Minimum Cement Content.** It shall be worked out as per the Concrete Mix Design for different strength and survivability requirements, based on ACI specifications. The Minimum Cement Content shall not be less than the survivability requirement, corresponding to the purpose of use. Workability of concrete may be increased by increasing cement content. A minimum cement content ranging from 385 to 445 Kg/m3 is recommended. Pozzolana such as blast furnace slag; fly ash etc. may be used.

**3.11. Handling of Concrete**

3.11.1. The temperature of mixed concrete immediately before placing shall not be more than 32°C.

3.11.2. Concrete shall be mixed for a period not less than 1½ minute after all materials including water is in mixer.

3.11.3. In case of Plant mixing, the mixing time shall neither be less than 50 seconds, nor more than 90 seconds.

3.11.4. In Transit mixing truck, mixing shall be continued for not less than 50 revolutions after all ingredients including water are in the drum. The mixing speed shall be 6-10 rpm and total number of revolutions should be limited to 300.

3.11.5. In case of "Hauling".; mixed concrete may be transported to delivery point in truck agitators or truck mixers, operating at the speed designated by the manufacture. For zero slump to be laid by paver, concrete will be hauled in open trucks, which will be protected against rain or exposure to the sun for [11]more than 20 minutes, when the ambient temperature exceeding 25°C".

3.11.6. When a truck mixer or agitator is used for transporting concrete to delivery point, discharge is completed within one (1) hour or earlier, or less than maximum 300 revolutions of the drum, whichever comes first.

3.11.7. When non-agitating hauling equipment is used, discharge shall be completed within one (1) hour, after adding cement to the aggregates.

3.11.8. The rate of delivery of the concrete during concreting operations shall be such that the interval between batches shall not exceed 20 minutes.

3.11.9. **Placing of Concrete.** Concrete shall not be poured in the forms until the Engineer-in-Charge has inspected the placing of the reinforcement, conduits, anchorages and has given his approval in writing. Following be ensured during pouring or placing of Concrete:-

(1) Low permeability or water-tightness is the key to good concrete. The mix should be properly proportioned to achieve minimum porosity and properly consolidated. Concrete, during and immediately after placing, shall be thoroughly vibrated, except lean concrete under footings and concrete deposited under water. Concrete in walls, beams, columns etc. shall be placed in horizontal layers, not more than 30 cm thick.

(2) The Concrete shall be vibrated internally or externally or both, as ordered by the Engineer-in-Charge. The vibration shall be done with care in such a manner as to avoid displacement of reinforcement, conduits, or wires.

(3) The compaction shall be done by mechanical vibration. The intensity of vibration shall be such as visible to affect a mass of Concrete with a 3cm slump over a radius of at least 0.5M. Concrete should not be over vibrated to avoid segregation of materials.

(4) Internal vibration shall be supplemented by such external vibrator as is necessary to ensure smooth surface and dense Concrete.

(5) Construction joints shall be made only where shown or described in drawings or called for in the pouring schedule, unless otherwise approved by Engineer-in-Charge.

(6) The temperature of Concrete under hot weather shall not exceed 32° C at the time of pouring. Following actions may keep Concrete temperature below the above limit:-

(a) Chilling of Concrete water by heat exchange coils or addition of broken ice.

(b) Cooling Aggregate by watering.

(c) Night work provided that above are rendered inadequate or un-satisfactory in their results. However, permission of the Engineer-in-Charge will be essential for night work.

(7) Concreting operations in Cold weather shall not be continued without the written approval of the Engineer-in-Charge, when a descending air temperature in the shade and away from artificial heat falls below 5°C, nor resumed until an ascending air temperature in the shade and away from artificial heat reaches 20°C. In such case, the mixing water and/ or aggregates shall be heated to not less than 21°C nor more than 66°C prior to being placed in the mixer, so that temperature of 30-90 mm (12" to 36") thick Concrete shall not be less than 10°C and not more than 27°C at the time of placing.

3.11.10. **Depositing.** Concrete shall be used as soon as mixed, deposited and well consolidated in layers not exceeding 30 cm thick. CC in which the initial set has taken place shall be rejected.

3.11.11. **Working up.** Carefully work up Concrete against surfaces and around reinforcement so that later is not displaced.

3.11.12. **Curing of Concrete.** Curing is essential to prevent loss of moisture from concrete, due to sun, drying winds, and traffic, until the specified curing has been completed. Concrete shall be protected from heavy rains for 24 hours and shall be cured for 14 days. All galleries, conduits and other formed openings through the Concrete shall be closed during entire curing period. Concrete shall be kept wet for 15 days after laying. Following methods are used for effective curing:-

3.11.12.1. **Water Method.** Unless otherwise approved, the concrete shall be moistened by maintaining all surfaces continuously (not periodically) wet for at least 14 days after initial setting. The temperature difference between curing water and Concrete shall not be more than 11°C (20°F). When in contact with mass concrete, steel forms shall be kept wet. Horizontal construction joints and finished horizontal surfaces shall be covered with uniform thickness of 50mm (2 inch) of Sand and kept continuously saturated to protect Concrete from frost or any other damages.

3.11.12.2. **Curing Compound Method.** Surfaces exposed to the air may be cured by the application of an impervious membrane, if approved by the Engineer-in-Charge, and if water/ cement ratio of concrete is not less than 0.5. The liquid membrane-forming curing compound shall conform to ASTM C-309. The compound shall be applied with a pressure sprayer in such a manner, so as to cover the entire Concrete surface with a uniform film, and shall be of such character that it will harden within 30 min after application. The amount of compound applied shall be ample to seal the surface of the Concrete thoroughly. Power operated spraying equipment shall be equipped with an operational pressure gauge and means of controlling the pressure. The curing compound shall be applied to the Concrete following the surface finishing operation, immediately after the moisture sheen begins to disappear from the surface, but before any drying shrinkage or craze cracks begin to appear. Should the film of compound be damaged from any cause before the expiry of seven (7) days, after the Concrete is placed in the case of structures, the damaged portion shall be repaired immediately with additional compound. The

curing compound shall be packaged in clean barrels or steel containers or shall be supplied from a suitable storage tank located at the job-site. Containers shall be well sealed with ring seals and lug type crimp lids. The linings of the containers shall be of a character that will resist the solvent of the curing compound. Each container shall be labeled with the manufacturer's name, specification number, batch number, number of gallons, and date of manufacture. It shall have a label warning concerning flammability. Curing compound may be sampled by the Engineer-in-Charge at the source of supply or at the job-site.

3.11.13. **Testing of Concrete.** Compressive Strength of Concrete will be determined from test cylinders in accordance with ASTM C-31 & ASTM C-39.

3.11.13.1 A set of 6 cylinders (150mm dia and 300mm length) be taken from each 50 cum of Concrete mix or fraction thereof placed each day. Three of the 6 cylinders, be tested after 7 days and the remaining three after 28 days.

3.11.13.2. The minimum average 28 days test result of all samples tested at any time shall be the specified 28 days Min Cylinder Compressive strength.

3.11.13.3. No individual sample tested after 28 days shall show a test result lower than 85% of the required 28 days.

3.11.13.4. Concrete represented by any single test cylinder that fails to comply with the requirement as above will be rejected unless the Contractor at his expense provides evidence that the strength and quality of the Concrete placed in the work are acceptable. If such evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in accordance with ASTM C-42. Test results of the cores should meet following requirements.

(1) Average test result of the cores shall NOT be less than the minimum required 28 days strength.

(2) No any individual core shall show strength less than 95% of the required 28 days strength.

(3) Other non-destructive methods of concrete tests may be allowed by the Engineer-in-Charge.

3.11.14. **Rejection of Concrete.** If above test results fail to comply with the requirements, concrete of that particular pour will be rejected and removed as directed by the Engineer-in-Charge.

## 3.12. Finishing Works

3.12.1. **Exposed Faces.** Exposed faces of cast in situ, pre-cast and reinforced concrete shall be brought to fair and even surface by thoroughly punning (by working the Concrete against the casings and the centering) and tamping, whilst the Concrete is being poured-in and also by working over the surface with a trowel. Immediately after the removal of casings or centering, remove any irregularities and stop up air holes using cement mortar where necessary, that will give an appearance as that of the original concrete. Unless otherwise stated, fair finish shall imply fair and smooth finish with or without rendering.

3.12.2. **Channels.** Channels formed in Concrete shall be finished fair to proper falls with bends, stopped ends etc., as required.

3.12.3. **Pointing.** The joints of Concrete block walling shall be raked out as the work proceeds and the surface cleaned and brushed. Flush pointing in addition shall be executed as required.

3.12.4. **Linear Labours (Small).** Refer to chamfers, splays, rounded angles, coved angles, bead, grooves, rebates not exceeding 100 mm girth, and moldings not exceeding 150 mm girth.

3.12.5. **Incidental Labours.** Refer to stops, meters, rounded ends, junctions, dishing etc., in connection with Linear or Super labour.

**3.13. Construction and Expansion Joints.** Will be provided as per Information Sheet Number IS-STR-59, 66 or as shown on drawing. Following be adhered during construction.

3.13.1. **Construction Joints**

3.13.1.1 Construction joints shall be as few as possible; and shall be made on horizontal and vertical planes only or at places shown on the drawings or approved by the Engineer-in-Charge. Where concreting is stopped on a vertical plane, as in beams, provide lap joint with approved stop board. Make provisions to allow the reinforcement to pass through the joints without being temporarily bent or otherwise displaced.

3.13.1.2. In case of slabs or walls, nail a 50mm (2") x 25mm (1") fillet slightly splayed (to permit easy removal) on the joint stop board to form a joggle running throughout the length of ‘the joint. Remove any concrete flowing pass the joint as soon as initial set occur. When concreting against a hardened surface is resumed, well roughen, wet, clean surface and apply cement sand slurry of same ratio as of mortar used in the concrete.

3.13.1.3. Provide approved water proofer in lieu of mortar at joint, in basement and water retaining walls more than 7.5M (30 ft) long, carry out concreting such that vertical gap of about 0.7M (2ft) width with vertical joggled ends at both sides is left out at about 7.SM (30 ft). Distances are filled in after 14 days of concreting the adjacent sections.

3.13.2. **Expansion Joints.** Form expansion joints accurately in the position and to the dimensions and details shown on the drawing and as instructed by the Engineer-in-Charge.

**3.14. Reinforcement.** It shall be worked out as per the design, fixed and measured separately as supplied and fixed under Section-9 of this Schedule (Steel and Iron work).

**3.15. Form-work**

3.15.1. **General.** Construct formwork and false work such that it is strong enough to support the load, imposed on them, by fresh Concrete and stresses imposed by vibrating equipment and traffic. Prevent settlement of support. All joints be water tight against the escape of cement and fines. Make due allowance (including camber) for settlement and movement of forms under fresh Concrete. If metal ties are used in conjunction with bolts to pass through the Concrete, do not leave the metal closer than 50 mm (2") from the face of Concrete.

3.15.2. Do not use damaged formwork. Provide shear bars as per Engineer in Charge's instructions at all construction joints. Maintain formwork fabrication tolerances and surface irregularities, as follows:-

3.15.2.1 Variations from Plumb in lines and surfaces of piers, walls and rises, 6mm (¼") per 3M (10 ft) but not more than 25mm (1").

3.15.2.2. For exposed corners, columns, central joints, grooves and other construction lines, 6mm (¼") in any bay or 6M (20 ft).

3.15.2.3. Variation from position of linear building lines and related columns, walls and partitions, 13mm (½") in any bay or 6M (20 ft) max and 25mm (1") in 12M (40 ft) or more.

3.15.2.4 Variation in size & location of sleeves, floors & wall openings, 6mm (¼").

3.15.2.5 Variation in cross-sectional thickness of slab and walls be between(-) 6mm (-¼") and(+) 12mm (+½").

3.15.2.6 Variation in footing plan dimensions to be between (-) 12mm (-½") and (+) 50mm (+2"). Layout displacement not more than 12mm (½") and verticality deviation not more than 1.0% of the footing width, in direction of displacement, but not more than 50mm (2") on top.

3.15.2.7 Suitable openings as required shall be provided in the formwork for the passage of piping ducts, channels etc. All forms shall be so constructed that they can be removed without damaging the Concrete. All exposed joints, edges and external corners shall be chamfered 37.5 mm (1½") at 45°, except as otherwise shown. Internal corners are filleted where indicated or required. Forms that are to be used more than once shall be maintained in serviceable condition and shall be thoroughly cleaned before reuse.

3.15.3. **Design of Formwork**

3.15.3.1. **All scaffolding and formwork / shuttering shall be of Steel, only.**

3.15.3.2. Forms shall result in final structure that conforms to shapes, lines, and dimensions of the members as per the design, drawing and specifications.

3.15.3.3. Forms shall be substantial and sufficiently tight to prevent leakage of mortar.

3.15.3.4. Forms shall be properly braced or tied together to maintain position and shape.

3.15.3.5. Forms and their support shall be designed so as not to damage previously placed structure.

3.15.3.6. Design of form work shall include consideration of the following factors:-

(1) Rate and method of placing Concrete.

(2) Construction loads including vertical, horizontal and impact loads.

(3) Special form requirements for construction of shells, folded plates, domes, architectural concrete or similar types of elements.

3.15.3.7. Forms shall be.removed in a manner as not to impair safety and serviceability ofthe structure. Concrete to be exposed by form removal, shall have enough strength, not to be damaged by removal operation.

3.15.4. **Coating / Oiling.** Shortly before Concrete is placed, forms for exposed surfaces shall be coated with approved non-staining form oil, which shall not interfere with the setting of the Concrete nor be otherwise deleterious. After oiling, surplus oil on the form surfaces and any oil on the reinforcing steel or other surfaces requiring bond with the Concrete shall be removed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before placing the Concrete.

3.15.5. **Removal of Formwork.** The Contractor shall be responsible for ensuring that sufficient time has elapsed for the Concrete to attain sufficient strength before removal of forms, but, no form be removed without prior approval of the Engineer-in-Charge. Forms shall be removed with care so as to avoid injury to Concrete. Formwork shall be removed as soon as practicable, keeping in view the minimum Concrete setting time requirements, to avoid delay in water curing, and to enable earliest practicable repair of surface imperfections. Formwork for the openings shall be constructed in such a manner as to be removed until the strength of tt)e Concrete is such that form removal will not result in perceptible cracking, spalling and breaking of edges of surfaces or other damage to the Concrete. In general, the approximate elapsed time before removal of formwork shall be as per Table 3-8.

**TABLE 3-8**
**Min Period for Formwork Removal**

| Position of Formwork | Min Period for Temps Over 10° C | Min Strength to be Attained |
|---|---|---|
| Vertical or near vertical faces of mass concrete | 24 hours | 0.2 C |
| Vertical or near vertical faces of reinforced walls beams and columns | 48 hours | 0.3 C |
| Undersides of arches, beams and slabs (formwork only) | 14 days | 0.5 C |
| Supports to underside of arches, beams and slab upto 3M (1Oft) span | 14 days | C |
| Supports and underside of beams, slabs larger than 3M (10 ft) span | 21 days | C |

**Notes**

(1) "C" is the Nominal strength for the grade of concrete used.
(2) At temperature below 10°C or if Cement other than Ordinary Portland (Type I) is used, the Engineer-in-Charge may instruct for longer periods.

## 3.16. Pre-Cast Concrete

3.16.1. **Concrete Blocks.** Concrete blocks shall be made on site or at a Concrete pre-cast factory, with proper quality control procedures in place. Concrete blocks shall be of sizes required as per drawings and shall conform to the requirements of ASTM C-90 "Standard Specification for Load Bearing Concrete Masonry Units unless specified otherwise.

3.16.1.1. Crushing strength shall be minimum 13 MPa (1900psi) unless otherwise required, considering overall dimension on the axis on which test is performed.

3.16.1.2. The blocks shall be Solid or Hollow as required and shall be carefully made, so that they are true in line and face with square corners and free from all defects. The cavities in Hollow blocks shall not be more than 25% of the total volume.

3.16.1.3. The Concrete for the blocks shall be prepared in Batching plant or a Concrete mixer in the proportion, determined by Concrete mix design, to give the required strength. Hand mixing shall not be allowed in any case, what so ever.

3.16.1.4. Concrete blocks shall be machine moulded. The Concrete be well worked into the moulds, vibrated, tamped and pressed to ensure that blocks are dense and free from voids. The blocks shall be cured by keeping moist, continuously for a period of at least ten (10) days and then shall be allowed to dry in shade for at least twenty (20) days before use in masonry.

3.16.1.5. All blocks shall have clean cut, straight and true edges, smooth dense faces of uniform appearance without voids, honeycombs, projections and be free from cracks, spalls, chips, rugged edges or other defects detrimental to their use.

3.16.1.6. Where blocks are to be plastered or rendered, the block surface shall have a coarse texture without compromising the strength, suitable for bonding the plaster as approved.

3.16.1.7. **Sizes of Blocks.** The commonly used and available sizes in the market are given below for guidance:-

(1) **Solid Blocks**

| | | |
|---|---|---|
| (a) | 200mm x 200mm x 300mm | **(8" x 8" x 12")** |
| (b) | 150mm x 200mm x 300mm | **(6" x 8" x 12")** |
| (c) | 100mm x 200mm x 300mm | **(4" x 8" x 12")** |

(2) **Hollow Blocks**

| | | |
|---|---|---|
| (a) | 200mm x 200mm x 400mm | **(8" x 8" x 16")** |
| (b) | 150mm x 200mm x 400mm | **(6" x 8" x 16")** |
| (c) | 100mm x 200mm x 400mm | **(4" x 8" x 16")** |

3.16.1.8. **Testing of Concrete Blocks.** The average 28 days Compressive strength of any six(6) blocks picked at random, after curing and drying shall not be less than 13 MPa (1900 psi) for load bearing walls and 6.9 MPa (1000 Psi) for non-load bearing walls, when tested in accordance with ASTM C-140. Appropriate strength requirement shall be considered to be satisfied, 1f none of the strength of the six (6) samples is below the specified strength, or if the average strength of the six (6) samples is not less than the specified strength and the difference between the highest and the least strength is not more than 20 % of the average.

3.16.2. **Kerb Stones.** The Kerb Stones shall have minimum 28 days Cylinder Compressive Strength of 21 MPa (3000 psi). It shall be cast using Plant Mix Concrete with proper shuttering and compaction arrangements to ensure strength, finish and quality. The Kerb Stones are marketed in various sizes, shapes and qualities. However,

for the purpose of this Schedule, the rates have been worked out for following specifications of Kerb Stones given in Table 3-9:-

**TABLE 3-9**

**Size and Specifications of Common Kerb Stones**

| S.No | Size (mm) | Dropper (mm) | Top (mm) | Chamfered (mm) | Strength MPa (psi) |
|---|---|---|---|---|---|
| 1 | **450 x 300 x 150** | 160 | 125 | 10 | 21.0 (3000) |
| 2 | **350 x 300 x 150** | 160 | 110 | 10 | 21.0 (3000) |
| 3 | **300 x 300 x 150** | 160 | 110 | 10 | 21.0 (3000) |

## METHOD OF MEASUREMENTS

**3.17. Attached Work.** In Reinforced Concrete (Pilasters, buttresses, string courses, beams, girders etc.):-

3.17.1. **Walls.** Measure all projection portions, with the walls and pay at the same rate.

3.17.2. **Floors or Roofs.** Measure all projecting portions (beams, haunches, etc.) separately and pay at the rate for beams, girders, columns etc.

**3.18. No deductions or additions (on any account) be made for:-**

(1) Ends of dissimilar materials, i.e. joists, beams, posts, girders, rafters, purlins, trusses, corbels, steps etc., not exceeding 460 Sq cm in section:

(2) Opening not exceeding 0.2 Sqm area.

(3) Linear (locking, rebated, tongued and grooved etc.).

(4) Linear labour (small) and incidental labour.

(5) The portions shaded at Figure 3-1 (measuring throughout as a x b), where these do not exceeding 40 Sq cm in section. If they exceed 40 Sq cm each, the work will be measured net.

(6) Channels (Figure.3-1) shall be measured as; (a x b) - ¾ (c x d), except where the shaded portion does not exceed 40 Sq cm in section.

(7) Other sections shall be measured net.

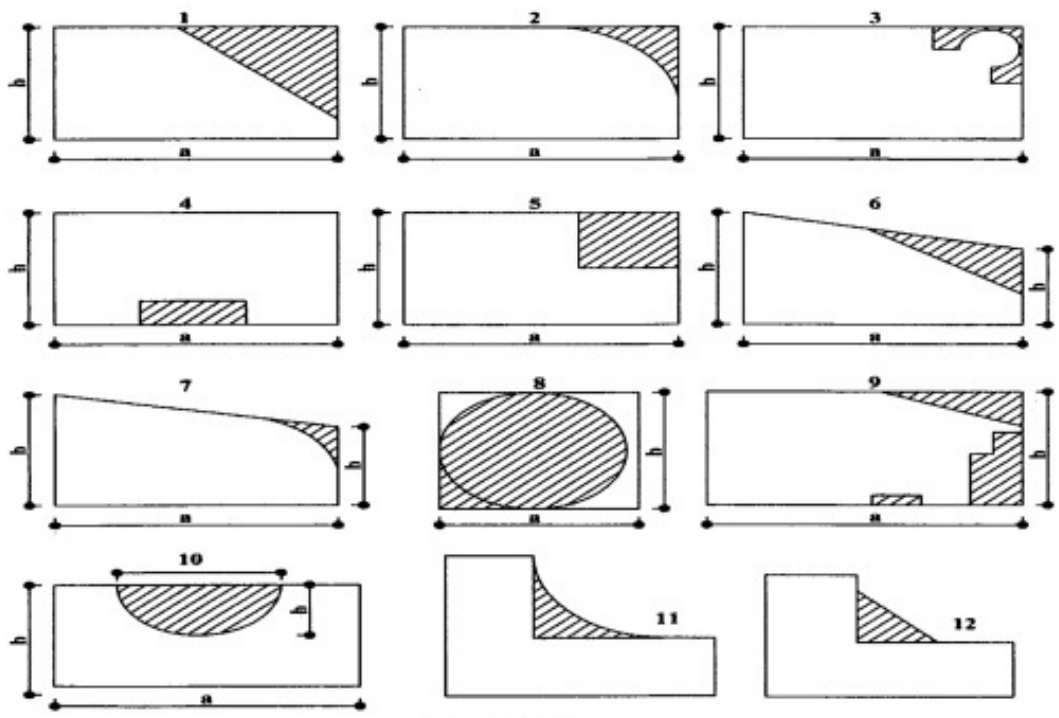



FIGURE : 3-1

**3.19. Hollow Block.** Measure as solid, under rate for hollow blocks.

**3.20. Staircases**

3.20.1 Measure spandrel steps net.

3.20.2 Measure half and quarter space landing as floors.

**3.21. Channel Formed in Poured Concrete.** When over 40 Sq. cm. in section, the curved waterway shall be deducted at¾ x width x depth (max dimensions).

## CLARIFICATION OF RATES

**3.22.** The rates, inter alia, include particularly:-

(1) All requirements specified here-above, as applicable.
(2) All materials and activities.
(3) Work in 150 mm (or less) layers.
(4) Work in any position and of any dimensions.
(5) Linear and incidental labour produced by formwork, cores.
(6) Curing and protection.
(7) Roughen surface of old concrete (where adjoining new), sweeping clean and watering.
(8) Hoisting upto 12M above or below ground.
(9) Cement shall **not** be issued under Schedule-B, for pre-cast or manufactured items like Solid /Hollow Blocks, Kerb Stones etc., which are procured from manufacturers. However, in case pre-casting is carried out at site as per the specifications, the required quantity of cement may be issued under Schedule 'B', as per the laboratory report for the Concrete mix, with prior written approval of the Engineer in Charge.

**3.23.** Walls include attached work (pilasters, buttresses, strings, cornices, plinths etc.) also partition and other works not specifically mentioned.

**3.24.** Stairs include stairs of any type, straight, doglegged, winding open or closed, and steps of square or spandrel section, any shape or plan, string carriages and landings less than¼ space.

**3.25.** The rates for the following include all necessary form work/shuttering and fair faces to exposed surfaces:-

(1) Concrete cast in situ.
(2) Pre-cast Concrete.
(3) Reinforced Concrete.

**3.26. Rates for Structural Concrete.** The Concrete having 28 days Minimum Cylinder Compressive strength 3000, 3500, 4000, 5000, 6000 and PQC 600 psi, including arrangement and use of Weigh Batching plant, concrete pumps, vibrators etc and transportation upto 10 Km by Transit Mixer have been accounted for in the rates.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Plain Cement Concrete (PCC)** | | |
| 3-1 | Providing and laying of **lean concrete** using crushed or broken stone graded; **1:6:12,** all as specified. | Cum | 6360 |
| 3-2 | Same as 3-1 but **PCC 1:4:8,** all as specified. | Cum | 7075 |
| 3-3 | Same as 3-1 but **PCC 1:3:6,** all as specified. | Cum | 7696 |
| 3-4 | Providing and laying of **PCC 1:3:6** all as specified in walls, partitions, slabs, sills, copings, channels, steps, string courses, corbels, pier caps, hinge stones, mantel pieces, louvers, chimney tops etc., including setting, jointing and pointing. | Cum | 9483 |
| 3-5 | Providing and laying of **PCC with 3000 psi compressive cylindrical strength** in all **non- structural elements** except formwork. | Cum | 8922 |
| 3-6 | Same as item 3-5 including formwork and fair faces to exposed surfaces. | Cum | 10852 |
| 3-7 | Providing and laying of **RCC with 3000 psi compressive cylindrical strength** in different **structural elements** (foundation etc.) including form work all as specified. Reinforcement measur and paid separately. | Cum | 10095 |
| 3-8 | Same as item 3-7 except form work. Reinforcement measured and paid separately. | Cum | 8731 |
| 3-9 | Same as item 3-7 but in roof slabs, landings, walls, plinth beams and bands etc. al as specified including form work (reinforcement measured and paid separately). | Cum | 13547 |
| 3-10 | Same as item 3-7 but columns, beams, stairs, posts, ,struts, piers, lintels, and the like including form work, all as specified. Reinforcement measured and paid separately. | Cum | 13921 |
| 3-11 | Providing and laying of **RCC with 3500 psi compressive cylindrical strength** all as specified in roof slabs, landings, walls, plinth beams and bands, etc., including form work. Reinforcement measured and paidseparately. | Cum | 15781 |
| 3-12 | Same as item 3-11 but in beams, columns, stairs, posts, struts, piers, lintels and the like. Reinforcement measured and paid separately. | Cum | 16047 |
| 3-13 | Same as item 3-11 but in foundations, independent column footings, and rigid floors etc. including form work as specified. Reinforcement measured and paid separately. | Cum | 12595 |
| 3-14 | Providing and laying of **RCC with 4000 psi compressive cylindrical strength** all as specified in roof slabs, landings, walls, plinth beams and bands, etc., including form work. Reinforcement measured and paidseparately. | Cum | 16239 |
| 3-15 | Same as item 3-14 but in beams, columns, stairs, posts, struts, piers, lintels and the like. Reinforcement measured and paid separately | Cum | 16613 |
| 3-16 | Same as item 3-14 but in foundations, independent column footings, and rigid floors etc. including form work as specified. Reinforcement measured and paid separately. | Cum | 13053 |
| 3-17 | Providing and laying of **RCC with 5000 psi compressive cylindrical strength** all as specified in roof slabs, landings, walls, plinth beams and bands, etc., including form work. Reinforcement measured and paidseparately. | Cum | 16490 |
| 3-18 | Same as item 3-17 but in beams, columns, stairs, posts, struts, piers, lintels and the like. Reinforcement measured and paid separately. | Cum | 16864 |
| 3-19 | Same as item 3-17 but in foundations, independent column footings, and rigid floors etc. including form work as specified. Reinforcement measured and paid separately. | Cum | 13304 |
| 3-20 | Providing and laying of **RCC with 6000 psi compressive cylindrical strength** all as specified in roof slabs, landings, walls, plinth beams and bands, etc., including form work. Reinforcement measured and paidseparately. | Cum | 17028 |
| 3-21 | Same as item 3-20 but in beams, columns, stairs, posts, struts, piers, lintels and the like. Reinforcement measured and paid separately. | Cum | 17402 |
| 3-22 | Same as item 3-20 but in foundations, independent column footings, and rigid floors etc. including form work as specified. Reinforcement measured and paid separately. | Cum | 13843 |
| 3-23 | Providing and fixing of **PVC water stopper 250mm wide and 12 mm thick.** | Metre | 2331 |
| 3-24 | Same as 3-23 but **10 mm thick.** | Metre | 2134 |
| 3-25 | Same as 3-23 but **225 mm wide and 8 mm thick.** | Metre | 1543 |
| 3-26 | Same as 3-23 but 225 mm wide and 5 mm thick. | Metre | 952 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Pre Cast Solid / Hollow Blocks** | | |
| 3-27 | Providing and laying of **PCC Sol(d Blocks for load bearing walls** as specified in building blocks walls including setting and jointing in CM 1:6 upto Basement / GF roof level. | Cum | 11188 |
| 3-28 | Same as item 3-27, but upto 1st floor roof level / Basement. (1[51] lower ground level) | Cum | 11325 |
| 3-29 | Same as item 3-27, but upto 2nd floor roof level / Basement. (2°[d] lower ground level) | Cum | 11462 |
| 3-30 | Providing and laying of **PCC Solid Blocks for non - load bearing walls** as specified in building blocks walls including setting and jointing in CM 1:6 upto GF roof level. | Cum | 10437 |
| 3-31 | Same as item 3-30, but upto 1st floor roof level / Basement (1[51] Lower Ground level). | Cum | 10725 |
| 3-32 | Same as item 3-30, but upto 2nd floor roof level / Basement (2nd Lower Ground level). | Cum | 10711 |
| 3-33 | Providing and laying of **PCC Hollow Blocks, for load bearing walls,** as specified in building blocks walls, including setting and jointing in CM 1:6 upto Basement (1st Lower Ground)/ GF roof level. | Cum | 10868 |
| 3-34 | Same as item 03-33, but upto 1st floor roof level/ Basement (1[51] Lower Ground level). | Cum | 11005 |
| 3-35 | Same as item 03-33, but upto 2nd floor roof level/ Basement (2nd Lower Ground level). | Cum | 11142 |
| 3-36 | Providing and laying of **PCC Hollow Blocks, for non-load bearing walls,** as specified in building blocks walls, including setting and jointing in CM 1:6 upto Basement / GF roof level | Cum | 10112 |
| 3-37 | Same as item 03-36, but upto 1st floor roof level / Basement. (1[51] lower ground level) | Cum | 10306 |
| 3-38 | Same as item 03-36, but upto 2nd floor roof level / Basement. (2°[d] lower ground level) | Cum | 10386 |
| 3-39 | **Pointing** to PCC Solid/ Hollow Blocks in CM (1:4). | Sqm | 171 |
| 3-40 | **Additional Labour Cost** | | |
| 3-41 | Add labour cost for **hoisting/ lowering** of concrete (Cast in situ) for each storey beyond 12 M above or below GL. | Cum | 118 |
| | Same as item 03-40, but **Pre-cast PCC Solid/ Hollow blocks.** | Cum | 186 |
| 3-42 | **RCC Jali** | | |
| 3-43 | Supply and fix, 38mm thick **Precast RCC jali,** including setting and jointing in CM 1:1, all as specified. | Sqm | 888 |
| 3-44 | Same as item 03-42, but 50 mm thick. | Sqm | 1082 |
| 3-45 | Same as item 03-42, but 75 mm thick. | Sqm | 1293 |
| 3-46 | Fixing only of item 03- 42 to 03-44. | Sqm | 406 |
| | Add to item 03-42 to 03-45, if fixed in repair. | Sqm | 107 |
| | **Kerb Stone** | | |
| 3-47 | Providing and laying **Precast PCC Kerb-stone,** size 300 x 300 x 150 mm including setting, jointing and pointing in CM 1:4 all as specified. | Metre | 473 |
| 3-48 | Same as item 03-47, but size 350 x 300 x 150 mm. | Metre | 550 |
| 3-49 | Same as item 03-47, but size 450 x 300 x 150 mm. | Metre | 574 |
| | **Expansion Joints** | | |
| 3-50 | Form **expansion joint** 13mm thick in RCC roof or floor slabs etc., and fill in with bitumen grade 10-20. | Sqm | 2647 |
| 3-51 | Supply and fix, **Copper sheet** 24 gauge in expansion joint (girth measurement). | Sqm | 7116 |
| 3-52 | Same as item 03-51, but using 26 gauge. | Sqm | 5825 |
| 3-53 | Supply and fix, **GI sheet** 24 gauge in expansion joints (girth measurement). | Sqm | 5569 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 3-54 | Supply and fix **Aluminium cover strip** 60mm wide and 2mm thick with all fittings complete for all joints. | Metre | 342 |
| 3-55 | Same as above 3-54 but 100 mm wide. | Metre | 338 |
| 3-56 | Same as item 03-54, but fixed in sections. | Metre | 617 |
| 3-57 | Extra for lead beyond 10 Km to 15 Km or part thereof for weigh batch col1crete. | Cum | 260 |
| 3-58 | Add to item 3-7 to 3-10, if crystalline water proofing chemical material is added to cement at the rate of 2% by weight. | Cum | 6336 |
| 3-59 | Add to item 3-11 to 3-13, if crystalline water proofing chemical material is added to cement at the rate of 2% by weight. | Cum | 8064 |
| 3-60 | Add to item 3-14 to 3-16, if crystalline water proofing chemical material is added to cement at the rate of 2% by weight. | Cum | 8218 |
| 3-61 | Add to item 3-17 to 3-19, if crystalline water proofing chemical material is added to cement at the rate of 2% by weight. | Cum | 9120 |
| 3-6 | Add to item 3-20 to 3-22, if crystalline water proofing chemical material is added to cement at the rate of 2% by weight. | Cum | 9216 |

# SECTION-4

# BRICK **MASONRY**

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-4
# BRICK MASONRY

## SPECIFICATIONS

**4.0.** The section covers brick work, pointing and Damp Proof Course (DPC) etc.

## MATERIAL REQUIREMENTS

### 4.1. Bricks

4.1.1. Bricks to be hard, square and well burnt, even in size, and to be free from modules of lime. Bricks may be either sand or soap melded.

4.1.2. **Size of Bricks**

4.1.2.1. Hand made burnt bricks shall not be less than (220 mm x 105 mm x 67 mm)

4.1.2.2. Machine made burnt bricks shall not be less than (228 mm x 114 mm x76 mm)

4.1.3. Bricks shall be well burnt, of uniform color, regular in shape and size with square corners / parallel faces, and should emit a clear ringing sound when struck with each other. Bricks are manufactured from clay, shale, or similar naturally occurring earthy substances and subjected to a heat treatment at elevated temperatures (firing). The heat treatment must develop a fired bond between the particulate constituents to provide the strength and durability requirements. Table 4-1 shows maximum limit of water absorption test and compressive strength of bricks.

**TABLE 4-1**

| Description | Water Absorption (by weight) | Compressive strength Kg / Sq.cm (psi) |
|---|---|---|
| Burnt bricks (First Class) | 16.67% (Max) when soaked for 1 hour | a. 105.46 Kg/ Sq. cm. (1500 psi Min) for ordinary brick masonry<br>b. 126.55 Kg/ Sq. cm (1800 psi Min) for water bearing brick masonry |

**4.1.4** The durability of a clay masonary unit is related to its grade. The grade and type of clay masonry units are defined in ASTM C 62, C 216, and C 652. Generally, First Class bricks being used in masonry work shall meet these grades.

### 4.2. Cement

4.2.1. The Cement shall be Ordinary Portland normal setting, of any brand, complying in all respects with BS #12.

4.2.2. Cement, unless otherwise, specified to be of any particular quality, shall mean Ordinary Normal Setting Cement.

4.2.3. Sulphate Resistant Cement shall comply with manufacturer's specifications.

**4.3. Sand.** Shall be sharp, cubical, hard and dense, the whole of which shall pass through 5mm Sieve and 2-10% through Sieve# 100. It should be free from organic impurities and clay lumps.

## CONSTRUCTION REQUIREMENTS

### 4.4. Brickwork

4.4.1. All First class burnt bricks to be thoroughly soaked in water, before being laid in CM. The joints of brickwork shall not be less than 6 mm or more than 10 mm in thickness.

4.4.2. All joints to be well flushed up at every course. The walls shall be carried up regularly, not leaving any part more than one meter (1M) lower than another, unless special circumstances render this impracticable.

4.4.3. Any wall left at different level to be raked back, courses be properly leveled, jambs and other angles plumbed as the work proceeds.

4.4.4. With the use of burnt bricks of traditional size, as specified in Para 4.1.2, four courses of brickwork including four joints in case of Handmade bricks measured between 292 mm (6 mm thick joints) and 308mm (10mm thick joints) in height and for Machine made bricks, measured between 328mm (6mm thick joints) and 344mm (10mm thick joints). However, in alteration work, the brick work shall gauge with existing work, unless otherwise directed. Internal walling and backings to be in even courses with external facing, but bricks may be thicker and joint thinner, provided courses bond with the work.

4.4.5. All brickwork to be built in English bond, unless otherwise specified. No half brick (bats) to be used, except, where necessary to complete the bond.

4.4.6. External facing be of sound hard bricks of good shape and uniform colour (Unless mottled or multi-coloured bricks are required) with square and sharp edges, selected from stacks, deposited on site.

4.4.7. Joints of brickwork will be struck, cleaned and the mortar pressed while the brickwork proceeds, using additional mortar, if required. Raking out joints will not be done.

4.4.8. Pointing the brickwork will be a separate process, including raking out joints and using different mortar from that of brickwork mortar. Pointing will not be done in the same mortar.

4.4.9. The joints on faces, which are to be plastered or pointed, should be raked 10mm deep, while the mortar is green, but not later than 24 hours after the brick work is done.

4.4.10. The pointing or striking out joints will normally be adopted as given below:-

(1) Weather struck joints / pointing will generally be adopted for external work where the walls are not plastered.

(2) Recessed joints / pointing will generally be adopted for pillars, fireplaces or other ornamental work / faces, required both internally and externally, where so ordered.

(3) Tuck-pointing will be done on surfaces, specially ordered by the Engineer-in-Charge.

4.4.11. All new work in CM will be kept watered and damp for such periods as directed, not exceeding 14 days and where it is to be built on old work, it will be kept watered for 7 days.

**4.5. Brickwork in Arches.** Bricks to be properly made or dressed (cut and rubbed) to template, as specified and joints not to exceeding 6mm in thickness, where half brick rings are permitted. Header brick or lacing courses will be ex-1cuted as directed by the Engineer-in-Charge.

**4.6. Mortar.** The proportions given are by volume. A 50 Kg bag of cement forms a unit of 0.035 Cum (gauge box of 30 cm x 30 cm x 39 cm).

4.6.1. **Cement Mortar (CM).** To be composed of one part of cement to number of parts of sand specified. The ingredients of CM shall be mixed dry, sufficient water added through a rose to make the mixture workable and then thoroughly mixed.

**4.7. Cavity Walls.** The thickness of skin be as specified. The skins to have 57mm cavity in between, and be tied together with cranked galvanized iron wall ties 19mm x 5mm with end spilt and fish-tailed, spaced one Metre(1M) apart to every third course of brick work.

**4.8. Damp Proof Course (DPC)**

4.8.1. **Using Hessian Cloth impregnated with bitumen**

4.8.1.1. Prepare surface clean of all dust etc.

4.8.1.2. Apply coat of hot bitumen using 7.5 Kg / 10 Sqm on smooth finished concrete/plastered surface leaving no pinholes etc. to safeguard against any possibility of capillary action.

4.8.1.3. Spread one layer of Hessian Cloth# 2 on full width of the wall with a lap of 51 mm, where required.

4.8.1.4. Thoroughly soak the Hessian cloth, laid with hot bitumen using 9.75 Kg / Sqm.

4.8.1.5. Blind top surface with sand, using 0.12 Cum / 10 Sqm and proceed with the super-structures.

4.8.2. **Using Polythene Sheet.** It shall be of uniform thickness not less than 0.20 mm thick and laid evenly on smooth surface. There should be no perforation, cracks, cuts etc. No overlaps are allowed, as far as possible.

**4.9. Watering and Protection.** All brick work, after pointing shall be kept wet for such periods as directed, not exceeding 14 days. Cover up and protect all brick work from damage by frost or otherwise, until curing process is completed.

## METHOD OF MEASUREMENTS

**4.10. Thickness, etc.** The following shall be allowed when measuring:-

(1) Measure length and height to the nearest cm.

(2) Thickness of walls, built in burnt bricks will be measured in multiple of 115mm i.e. 115, 230, 345, 460 mm and so on, without considering the increased width on account of the mortar in the joints. In case of cavity or similar walls, built in brick on edge, the thickness will be measured as 75mm or multiple of 75mm.

**4.11. Deductions.** No deductions shall be made in brick work for opening, not exceeding 0.35 Sqm in area. No 'deduction shall be made for plates, strings, relieving arches, lintels, sills etc., 150mm deep and fire place flues.

**4.12. Arches.** Arches, built in cut and rubbed bricks will be measured separately and the rate including use and waste of shuttering. The contents of arches will be deducted from brick work. No deduction will be made for cambers of arches.

**4.13. Cavity Wall.** In cavity wall, the width of cavity will not be included in thickness of the wall.

**4.14. Cornices, etc.** Only girth of the actual projection shall be measured for the "extra only" payment.

**4.15. Attached Work.** Measure pillars, pilasters, corbelling and similar projection, as brick work.

**4.16.** No deduction or addition shall be made on any account for ends of dissimilar materials. i.e. joints, beams, posts, girders, rafters, purlins, trusses, corbels, steps etc., not exceeding 450 cm in section.

## CLARIFICATION OF RATES

**4.17.** The rates, inter alia include particularly:-

(1) Rough relieving arches
(2) Beam filling (measured solid)
(3) Rough and fair cutting
(4) Striking joints as work proceeds, raking out joints if pointing to be done in mortar, other than brick work mortar
(5) Raking out joints for plaster and pointing
(6) Forming chases, etc.
(7) Leveling up and preparing walls for DPC
(8) Bedding wall plates in or on wall, bedding and pointing frames in mortar, bedding roof tiles and corrugated sheets in or on wall solidly in mortar and making good the same
(9) Holes (cut and form holes, for fixing pipes etc.) and making good the same
(10) Building exposed faces fair
(11) Work in cavity walls .
(12) Work in any position, in small or large quantities and in any thickness
(13) Connecting up new work and old (brick work in toothing to be measured with new work)
(14) Re-facing with new bricks includes headers and stretchers
(15) Height of each floor upto 4M. If height exceeding 4M, rate of next story will be applicable to that portion

**4.18.** Rates for burnt brickwork also apply to Reinforced brick work (Reinforcement and shuttering to be paid separately)

**4.19.** Pointing in a different mortar, when specified or ordered, will be paid for extra.

**4.20.** Bricks in cut and rubbed arches includes:-

(1) Cantering and brick work in soffits
(2) Skew cutting.

**ITEM RATES**

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Brickwork (Ground Floor)** | | |
| 4-1 | Burnt brick work, in walls **115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto G.F roof level.** | Cum | 13523 |
| 4-2 | Same as item 04-1, but **CM 1:4.** | Cum | 13236 |
| 4-3 | Same as item 04-1, but **CM 1:6.** | Cum | 12905 |
| 4-4 | Burnt brick work, in wall **over 115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto G.F roof level.** | Cum | 12315 |
| 4-5 | Same as item 04-4, but **CM 1:4.** | Cum | 12027 |
| 4-6 | Same as item 04-4, but **CM 1:6.** | Cum | 11699 |
| | **Brickwork (First Floor)** | | |
| 4-7 | Burnt brick work, in wall **115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto 1st floor roof level.** | Cum | 13720 |
| 4-8 | Same as item *04-7,* but **CM 1:4.** | Cum | 13429 |
| 4-9 | Same as item 04-7, but **CM 1:6.** | Cum | 13106 |
| 4-10 | Burnt brick work, in wall **over 115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto 1st floor roof level.** | Cum | 12467 |
| 4-11 | Same as item 04-10, but **CM 1:4.** | Cum | 12179 |
| 4-12 | Same as item 04-10, but **CM 1:6.** | Cum | 11855 |
| | **Brickwork (Second Floor)** | | |
| 4-13 | Burnt brick work, in walls **115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto 2nd floor roof level.** | Cum | 13916 |
| 4-14 | Same as item 04-13, but **CM 1:4.** | Cum | 13627 |
| 4-15 | Same as item 04-13, but **CM 1:6.** | Cum | 13302 |
| 4-16 | Burnt brick work, in walls **over 115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto 2nd floor roof level.** | Cum | 12621 |
| 4-17 | Same as item 04-16, but **CM 1:4.** | Cum | 12332 |
| 4-18 | Same as item 04-16, but **CM 1:6.** | Cum | 12006 |
| | **Brickwork (Below Ground)** | | |
| 4-19 | Burnt brick work, in wall **115 mm thick,** laid and jointed in CM 1:3, straight or to curve with inner radius of 6m and over, **upto 4.25 m depth.** | Cum | 14308 |
| 4-20 | Same as item 04-19, but **CM 1:4.** | Cum | 14019 |
| 4-21 | Same as item 04-19, but **CM 1:6.** | Cum | 13694 |
| 4-22 | Burnt brick work, in wall **over 115** mm **thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **upto 4.25** m **depth.** | Cum | 13214 |
| 4-23 | Same as item 04-22, but **CM 1:4.** | Cum | 12925 |
| 4-24 | Same as item 04-22, but **CM 1:6.** | Cum | 12600 |
| 4-25 | Burnt brickwork, in wall **115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **from 4.25m to 8.25 m depth.** | Cum | 14544 |
| 4-26 | Same as item 04-25, but **CM 1:4.** | Cum | 14277 |
| 4-27 | Same as item 04-25, but **CM 1:6.** | Cum | 13929 |
| 4-28 | Burnt brick _work, in wall **over 115 mm thick,** laid and jointed in **CM 1:3** straight or to curve with inner radius of 6m and over, **from 4.25 m to 8.25 m depth.** | Cum | 13182 |
| 4-29 | Same as item 04-28, but **CM 1:4.** | Cum | 12893 |
| 4-30 | Same as item 04-28, but **CM 1:6.** | Cum | 12567 |
| 4-31 | Burnt brick work, in wall **115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of 6m and over, **from 8.25 m to 12 m depth.** | Cum | 14792 |

| Sr No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 4-32 | Same as item 04-31, but **CM 1:4.** | Cum | 14503 |
| 4-33 | Same as item 04-31, but **CM 1:6.** | Cum | 14177 |
| 4-34 | Burnt brick work, in walls **over 115 mm thick,** laid and jointed in **CM 1:3** straight or to curve with inner radius of 6m and over, **from 8.25 m to 12** m **depth.** | Cum | 13397 |
| 4-35 | Same as item 04-34, but **CM 1:4.** | Cum | 13092 |
| 4-36 | Same as item 04-34, but **CM 1:6.** | Cum | 12767 |
| | **Additional Labour Cost** | | |
| 4-37 | Additional labour cost, for each story of building above 2nd floor roof level, for burnt brick work, straight or curve with inner radius 6m and over, in any mortar. | Cum | 379 |
| | **Brickwork (Well etc.)** | | |
| 4-38 | Burnt brick work, in wall **115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of less than 6m and **upto 4.25 m depth.** | Cum | 16352 |
| 4-39 | Same as item 04-38, but **CM 1:4.** | Cum | 16063 |
| 4-40 | Same as item 04-38, but **CM 1:6.** | Cum | 15737 |
| 4-41 | Burnt brick work, in wall **over 115 mm thick,** laid and jointed in **CM 1:3** straight or to curve with inner radius less than 6m, **upto 4.25 m depth.** | Cum | 14580 |
| 4-42 | Same as item 04-41, but **CM 1:4.** | Cum | 14291 |
| 4-43 | Same as item 04-41, but **CM 1:6.** | Cum | 13965 |
| 4-44 | Burnt brick work, in wall **115 mm thick** laid and jointed in **CM 1:3,** straight or to curve with inner radius less than 6m, **above 4.25m to 8.25 m depth.** | Cum | 16800 |
| 4-45 | Same as item 04-44, but **CM 1:4.** | Cum | 16512 |
| 4-46 | Same as item 04-44, but **CM 1:6.** | Cum | 16186 |
| 4-47 | Burnt brick work in wall **over 115 mm thick** laid and jointed in **CM 1:3** straight or curve with inner radius less than 6m, **above 4.25 m to 8.25 m depth.** | Cum | 14853 |
| 4-48 | Same as item 04-47, but **CM 1:4.** | Cum | 14566 |
| 4-49 | Same as item 04-47, but **CM 1:6.** | Cum | 14239 |
| 4-50 | Burnt brick work in wall **115 mm thick** laid and jointed in **CM 1:3** straight or to curve with inner radius of less than 6m, **above 8.25 m to 12 m depth.** | Cum | 17243 |
| 4-51 | Same as item 04-50, but **CM 1:4.** | Cum | 16955 |
| 4-52 | Same as item 04-50, but **CM 1:6.** | Cum | 16629 |
| 4-53 | Burnt brick work, in wall **over 115 mm thick,** laid and jointed in **CM 1:3,** straight or to curve with inner radius of less than 6m, **above 8.25** m **to 12 m depth.** | Cum | 15127 |
| 4-54 | Same as item 04-53, but **CM 1:4.** | Cum | 14838 |
| 4-55 | Same as item 04-53, but **CM 1:6.** | Cum | 14512 |
| | **Arches** | | |
| 4-56 | Cut or rubbed brick work, in arches and vaults etc., laid and jointed in **CM 1:3.** | Cum | 30766 |
| 4-57 | Same as item 04-56, but **CM 1:4.** | Cum | 30478 |
| | **Cavity Walls** | | |
| 4-58 | Extra to brick for forming cavity, 57 mm wide, laid and jointed in **CM 1**: , as specified, one face of the wall to be measured. | Sqm | 663 |
| 4-59 | Facing with machine tiles built in **CM(1:3)** (228 x 114 x 43mm to 47mm thick) | Sqm | 3306 |
| | **Pointing to Brickwork** | | |
| 4-60 | **Pointing, flush or recessed in CM 1:3,** to old or new brick work, built in any mortar. | Sqm | 383 |
| 4-61 | Same as item 04-60, but in **CM 1:4.** | Sqm | 377 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 4-62 | Same as item 04-60, but in **CM 1:6.** | Sqm | 371 |
| 4-63 | **Tuck pointing, in CM 1:3,** to old or new brick work, built in any mortar. | Sqm | 436 |
| 4-64 | Same as item 04-63, but in **CM 1:4.** | Sqm | 431 |
| 4-65 | Same as item 04-63, but in **CM 1:6.** | Sqm | 425 |
| 4-66 | **Struck pointing, in CM 1:1,** to old or new brick work, built in any mortar. | Sqm | 479 |
| 4-67 | Same as item 04-66, but in **CM 1:2.** | Sqm | 455 |
| 4-68 | Racking out joints of old walls, built in any mortar, including preparing surface for re-pointing. | Sqm | 200 |
| | **Damp Proof Course (DPC)** | | |
| 4-69 | **13mm thick DPC of CM 1:3** mixed with approved water resistant material 3% by weight. | Sqm | 449 |
| 4-70 | Same as item 04-69, but **20 mm thick:** | Sqm | 624 |
| 4-71 | **50mm thick P.C.C 1:2:4,** using 3mm aggregate and finished smooth with steel float, covered with two coats, each of hot bitumen@ 0.75 kg per Sqm and blinded with 0.012 cum of sand per Sqm. | Sqm | 872 |
| | **Miscellaneous** | | |
| 4-72 | Cutting out, in any mortar, and facing up with brick work in CM 1:3, where old walls had been binded in and removed. | Sqm | 1518 |
| 4-73 | Cutting out, **Decayed brick work** in any mortar, and re-facing with new bricks (any bond) in CM 1:3 and pointing/ striking in same mortar 115 mm thick. | Sqm | 1745 |
| | **Brick Shuttering** | | |
| 4-74 | Shuttering for slabs, landing, lintels, beams, columns and the like etc. | Sqm | 672 |

# SECTION-5

# STONE **MASONRY**

## RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-5
# STONE MASONRY

## SPECIFICATIONS

**5.0.** This section covers stone masonry and pointing etc.

### MATERIAL REQUIREMENTS

**5.1.** **Stone** for walling, etc, shall be:-

(1) Of the best quality, obtained in the locality.

(2) Hard, sound, free from veins flaws or defects.

(3) Laid in its natural bed as required.

(4) Of suitable sizes and in one piece, where ordered.

(5) Any of the Sandstone, limestone, granite, trap, quartzite, etc., according to the locality.

(6) All other stones for walling etc, e.g. Laterite and stone inferior to the one in Para 5.1.(1) to 5.1.(4) above shall be classified as of second quality and payment made accordingly.

**5.2.** **Cement.** The Cement shall be ordinary Portland, normal setting cement of brand, complying in all respects with BS # 12. Cement, unless, otherwise, specified to be of any particular quality type, shall mean Ordinary Normal Setting cement.

**5.3.** **Sand.** Shall be from approved source and free of dust and salt.

**5.4.** **Mortar.** The proportions given are by volume. A Cement bag of 50 Kg forms a unit of 0.035 Cum (gauge box of 30cm x 30cm x 39cm).

5.4.1 **Cement Mortar (CM).** To be prepared of one part of cement to the number of parts of sand specified. The ingredients of CM shall be mixed dry, sufficient water be added to make the mixture workable and then thoroughly mixed.

**5.5.** **Typical Random Rubble Brought Up To Courses.** It is shown in figure 5 -1 below.

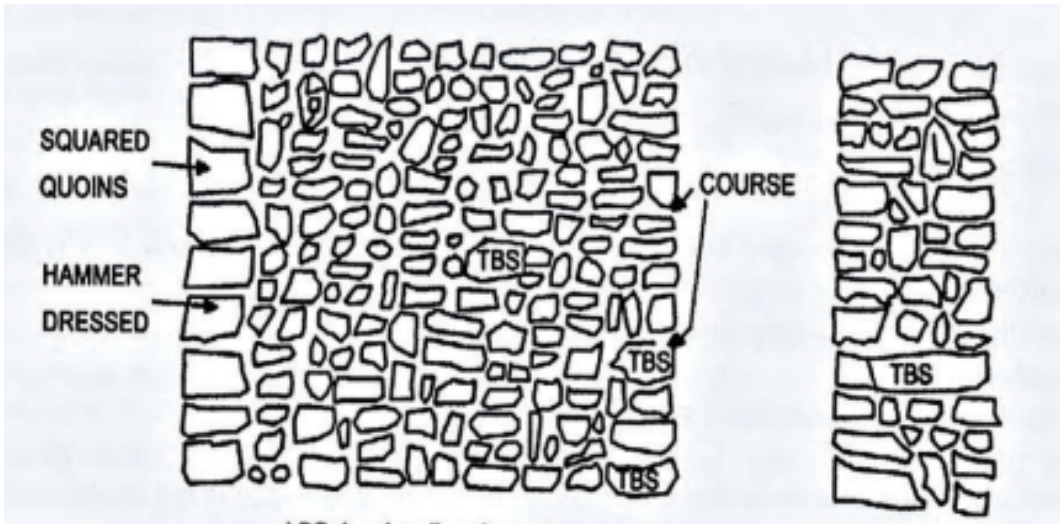



FIGURE : 5-1

5.5.1. **Face.** Roughly hammer dressed. No face stone to be narrower or shorter than its height.

5.5.2. **Beds** & **Joints.** Not to exceed 19 mm thick. Side joints in each course shall break joint at least 75 mm with those of courses above and below and not form an angle with bed joints less than 60°.

5.5.3. **Through Bonding Stone (TBS)** & **Lap Bonding Stone (LBS).** Three per 1 Sqm of face and staggered, No stone to tail to a point. In walls over 600 mm thick, LBS may be used in lieu of TBS.

5.5.4. **Quoins.** Face beds to be squared back 100 mm and joints 63 mm.

5.5.5. **Hearting.** Stone be not less than 150 mm in any direction, bedded with mortar, chips and spalls, being wedged in to avoid thick beds and joints of mortar. Vertical plumbs are placed wherever possible, projecting not less than 150 mm to form bond between successive courses.

## CONSTRUCTION REQUIREMENTS

**5.6. Stone Masonry.** All stones to be soaked in water for two hours and should not absorb water more than 5 - 10% by weight, before being laid in CM. All joints are well flushed up at every course. The walls shall be carried up regularly not leaving any part more than one meter (1M) lower than another unless, special circumstances render this impracticable. Any wall left at different levels to be raked back, courses to be properly leveled, quoins, jambs and other angles plumbed, as the work proceeds.

**5.7.** Stone masonry walls required to be plastered shall be raked, not less than 10mm deep, when the mortar is green, but not later than 24 hours after the work is done.

**5.8.** Joints of stonework, which are to be struck, will be cleaned and the same mort;ar pressed while the stonework proceeds using additional mortar, if required, Raking out joints will not he done. When pointing is to be done in stonework, it will be a separate process, including raking out joints and using different mortar from that 01 stonework mortar. Pointing will not be done with the same mortar.

**5.9.** The **Pointing** or striking out joints will normally be done as follows:-

(1) Flush pointing will only be used on inside surfaces.

(2) Weather struck joints / pointing will generally be adopted for external work, where the walls are not plastered.

(3) Recessed joints/ pointing will generally be adopted for pillars, fireplaces or other ornamental work/ faces required both internally and externally, where so ordered.

(4) Tuck-pointing will be done on surfaces specially ordered by the Engineer-in-Charge.

**5.10.** All new work in cement will be kept watered and damp for such period, as directed, not exceeding 14 days and where it is to be built on old work, the later will be kept watered for 2 days before hand.

**5.11. Stone Masonry in Arches.** The stone to be cut and dressed to template, as specified. The centering is approved by the Engineer-in-Charge and to be struck as directed by him.

## METHOD OF MEASUREMENTS

**5.12. Tolerances.** The thickness of wall shall be measured to the nearest cm.

**5.13. Deductions.** No deduction shall be made in stonework for openings not exceeding 0.35 Sqm in area. No deduction shall be made for plates, strings, relieving arches, lintels, sills etc. not exceeding 150 mm deep and fireplace flues.

## CLARIFICATION OF RATES

**5.14.** The rates, inter alia, include particularly:-

(1) Rough relieving arches.

(2) Beam filling (measured solid).

(3) Striking joints as work proceeds/ raking out joints if pointing is to be done in a mortar different to stone work mortar.

(4) Raking out joints for plaster and pointing.

(5) Forming chases, etc.

(6) Leveling up and preparing walls for DPC.

(7) Bedding wall plates in / on walls, bedding and pointing sash and door frames in mortar, bedding roof tiles and corrugated sheets in /on wall solidly in mortar and make good the same.

(8) Building in or cutting and pinning in with mortar to ends of joints, beams, etc. and making good the same.

(9) Holes (cut and form holes of fixing pipes, etc.)

(10) Coring and pargeting flues with mortar for flues, not exceeding 900 Sqcm sectional area.

{11) Stone work to curve exceeding inner radius 6M.

{12) Works in any position, in small or large quantities and in any thickness.

{13) Stone work up to 12 M above or below grounds.

{14) Connecting up new and old (stone work in toothing to be measured with new work).

{15) Cost of 1.25 Cum of stone per Cum of stonewall brought to Courses or built to Regular Course is included in the rates.

**5.15.** Wherever stone of Second quality is used, a deduction of 8% shall be made from "Material and Labour" rates.

**5.16.** Pointing, when specified or ordered will be _paid for extra.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Stone Walling** | | |
| | **Random Rubble - Stone Masonry Brought Upto Course** | | |
| 5-1 | **Random Rubble stone masonry** brought upto Courses, every 45 cm to 105 cm and 110 cm, roughly hammer dressed stone, well bonded, faced with hammer dressed selected stone, with square quoins and jambs, any thickness in building work and **laid dry.** | Cum | 3874 |
| 5-2 | Same as item 05-1, but laid and jointed in **CM 1:4.** | Cum | 6222 |
| 5-3 | Same as item 05-1, but laid and jointed in CM 1:6. | Cum | 5880 |
| 5-4 | Same as item 05-1, but in **retaining wall.** | Cum | 4311 |
| 5-5 | Same as item 05-4, but laid and jointed in **CM 1:4.** | Cum | 6813 |
| 5-6 | Same as item 05-4, but laid and jointed in **CM 1:6.** | Cum | 6471 |
| | **Pointing** | | |
| 5-7 | **Pointing struck, flush or recessed** to old or new stone masonry, any type, in **CM 1:3.** | Sqm | 575 |
| 5-8 | Same as item 05-7, but **Coloured, CM 1:3.** | Sqm | 618 |
| 5-9 | Same as item 05-7, but in **CM 1:4.** | Sqm | 570 |
| 5-10 | Same as item 05-9, but **Coloured, CM 1:4.** | Sqm | 606 |
| 5-11 | **Tuck pointing** to old or new stone masonry, any type, in **CM 1:3.** | Sqm | 581 |
| 5-12 | Same as item 05-11, but **Coloured, CM 1:3.** | Sqm | 620 |
| 5-13 | Same as item 05-11, but in **CM 1:4.** | Sqm | 572 |
| 5-14 | Same as item 05-13, but **Coloured, CM 1:4.** | Sqm | 608 |
| 5-15 | **Struck pointing** to old or new stone masonry, any type, in **CM 1:1.** | Sqm | 617 |
| 5-16 | Same as item 05-15, but **Coloured, CM 1:1.** | Sqm | 653 |
| | **Dressed Stonework** | | |
| 5-17 | Stone in blocks, with faces, beds and joints on One-Line Dressed as in bands, string and plinth courses, blocking courses pilaster, cornice, columns, caps, bases, copings, kneelers, lintels etc., (measured net), built in **CM 1:4.** | Cum | 9950 |
| 5-18 | Same as per item 05-17, but built in **CM 1:6.** | Cum | 9608 |
| | **Boulders in Crates, Pitching, etc** | | |
| 5-19 | Boulder filling dry hand packed as filling behind retaining walls in pitching and bunds. | Cum | 1734 |
| 5-20 | Boulder filling in crates including laying readymade wire mattress in position hand packing boulders folding wire mattress and lying its edges so as to form crates of the required shape and size etc. but excluding wire mattress and anchorage of crates, which are to be paid separately. | Cum | 1914 |
| | **Miscellaneous Repairs** | | |
| 5-21 | **Racking out Only,** joints of stone masonry, in any mortar, including preparation of surface for re-pointing, in any mortar. | Sqm | 42 |
| 5-22 | **Refastening or re-securing,** ends of balusters, newels, rag bolts let into stone, re-cutting of mortices and re-running with cement. | Each | 100 |
| 5-23 | Boulders laid, jointed and pointed in CM 1:4 in pitching. | Cum | 6262 |

SECTION- 6

# WOODWORK

## RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-6
# WOODWORK

## SPECIFICATIONS

**6.0.** This section covers Wood work. Technical Instructions may also be referred for further details.

## MATERIAL REQUIREMENTS

**6.1. Terms Used**

6.1.1. **Wood.** Fibrous substance that makes up a tree.

6.1.2. **Lumber.** Crudely finished felled tree.

6.1.3. **Timber.** Lumber that has been processed to beams and planks sawn square and holding the full sizes specified, whether wrought or unwrought, local and imported.

6.1.4. **Logs.** Round un-sawn timber over 200mm mean diameter (without bark).

6.1.5. **Ballies.** Round un-sawn timber not exceeding 200mm mean diameter (without bark).

6.1.6. **Plywood.** It shall conform to BS, EN-636 "Plywood Specifications".

6.1.7. **Face-Veneering.** Face-veneering shall be free from knots, streaks, irregularities and sap, and shall have matching grains.

6.1.8. **Seasoning of Timber.** Timber shall be properly seasoned. It shall be kiln or air-dried to reduce the moisture content up to 12% of its natural weight.

6.1.9. **Wrought Timber** means with surface, planed.

6.1.10. **Joints.** "Framed" means Mortice and Tenon or Dovetailed joints. All joints should fit fully and truly without wedging or filling. Framed joints are coated with glue, before being fixed together.

6.1.11. **Glue, Nails and Screws** shall be of best quality available in the market as per specifications of the Contract Agreement, sound engineering practice or as directed by the Engineer-in-Charge.

6.1.12. **All Faces Sawn and Angles Squared**

(1) **Fillet.** When less than 150 mm wide and less than 25 mm thick.
(2) **Batten.** When less than 75 mm wide and less than 50 mm thick i.e. under 40 sq cm sectional area.
(3) **Scantling.** When 75mm wide or over and 50mm thick or over - no upper limit.
(4) **Boarding.** When less than 50mm thick, except flooring, and the width is not less than 150 mm.

**6.2 Classification of Timber**

6.2.1. Keeping in view the characteristics, timber can be classified into soft wood and hard wood. Selection of timber depends upon the type of work and the engineering requirements. A comparison of both types is given in Table 6-1 for a better apprehension.

**6.3. Grading of Timber.** The following International Standards may be referred along with Technical Instructions:-

(1) IS 620 - Details about wooden tools handles.
(2) IS 401 - Specifies about the preservation of timber.
(3) IS 190 - Coniferous sawn timber.

In Pakistan, timber is generally graded as First Class and Second Class. **The only quality of timber that can be incorporated in a MES works is "First Class".**

6.3.1 **Grading criteria**

(1) Appearance (Through visual inspection)
  (a) Knot size and frequency (location unimportant).
  (b) Splits, cracks, checks (size and frequency).
  (c) Colour, grain uniformity, gum veins.
  (d) Utility - want, wane, cup, bow, spring, twist.
(2) Structural requirements (through machine testing)
  (a) Strength - Bending, tension, compression and shear.
  (b) Stiffness - Deflection.

**TABLE 6-1**

| Characteristics | Softwood | Hardwood |
|---|---|---|
| Source | Softwood is collected from conifer trees which are evergreen having needle-shaped leaves. | Hardwood is obtained from **trees,** which **lose** leaves in autumn. |
| Fiber | Less dense and straight | Close and dense. |
| Resin quality | Resinous wood contains good and regular texture and smell. | Non-resinous wood that has enough acid. |
| **Weight** | Lightweight and softer than hardwood. | Heavyweight and harder than softwood. |
| Color | Light in color. | Normally dark colored. |
| Resistance to fire | Poor, burn at a high rate. | Better than softwood. Burn **at a** very slow rate. |
| Weather resistance | If they are modified or treated then these may become resistant to weather having an environmental impact. | Naturally resistant to whether having a less environmental impact. |
| Ring structure | Distinct annual rings. | Annual rings are not distinct. |
| Vessels | Absent | Present |
| Tracheids | 90 to 95 % | 5 to 10 % |
| Medullary rays | Indistinct medullary rays. | Distinct medullary rays. |
| Growth rate | Soft wood trees grow faster. | Slower growth rate. |
| Wood branching | Creates more branches or shoots. | Have fewer shoots. |
| Tensile and shear strength | Good tensile and comparatively weaker shear strength. | Good tensile and shear strength. |
| Durability | Moderate to high | Very high |
| Workability | Easier to carve. | Difficult to curve. |
| Uses | Paper industry, artificial wood products, construction works and furniture, wood turning | Flooring, furniture, selected construction members, papermaking, veneer, boat building, wooden toys |
| Examples | Deodar, kail, chir, partal, araucaria, fir, juniper | Poplar, sheesham, kikar, teak, eucalyptus, Ash, oak, mahogany, walnut, maple, red meranti, olive, sandal, willow, beech, balsa, alder, hickory, shahtoot, mango |

6.3.2. **Quality Criteria of First Class Timber**

(1) Properly seasoned, at least three months air-drying for carpenter's work, preferably under cover in all cases.
(2) Moisture content less than 12%.
(3) To be of mature growth, uniform in texture and straight in fiber.
(4) It shall be free from sapwood, loose or dead knots (knots aggregating more than 75mm in a batten 180mm wide), open shakes, bit holes, rot, decay, chemical or water stains, other defects and blemishes.
(5) Minimum density of soft wood should be 35 lbs/cft and that of hard wood 48 lbs/cft.
(6) Typical odour and colour.

6.3.3. The timber shall be approved by the Engineer-in-Charge, before incorporation in the work.

**6.4. Selection of Timber.** The quality of timber must be ensured before selecting/ using it for a purpose. The quality can be ensured by investigating the properties of timber. At the same time, it is also essential to ensure that the timber is defect less. Timber will be approved by the Engineer-in-Charge, before incorporation in the work. During currency of work, in case of any dispute regarding timber, decision of the Controlling Officer shall be final. The work will not be commenced till the dispute is resolved.

**6.5. Properties of Timber.** Following are the physical and mechanical properties of timber:-

(1) **Colc>r.** Colar is a uniform property by which most trees are characterized as they show variation from tree to tree. Light color indicates weak timber. For example, freshly cut teak, Deodar, and Walnut have a golden yellow, whitish and dark brown shades respectively.
(2) **Appearance.** Smell is a good property as timbers for few plants as they can be identified by their characteristic aroma. Fresh cut timbers have a good smell. For example resinous smell from pine.
(3) **Hardness.** For the resistance of any kind of damage, hardness is an obvious property.

(4) **Specific Gravity.** Variation of timber in specific gravity {0.3-0.9) is found. It depends on pores present inside timber. The specific gravity of this light material is less than that of water (<1). But in case of compact wood where pores are almost absent and become heavier, their specific gravity increases up to 1.5.

(5) **Moisture Content.** Timbers are hygroscopic and gain water from nature (atmosphere). The absorption of water or dehydration depends on atmospheric humidity. If timber moisture content is high that means the timber quality is low. Water content is the risk of fungal attack.

(6) **Grain.** Several types of grain arrangement found. On the grain structure quality of timber varies. Grains remain closely related. **Straight grain** -Arrangement of vascular tissue (xylem and phloem) is important which grow parallel to the length of the timber that is termed as straight grain. **Coarse grain** - vascular tissue and fiber arranged broadly and widely. **Interlocked grain** - Instead of parallel arrangement twisted, a spiral arrangement may be found.

(7) **Shrinkage and Swelling.** The percentage of shrinkage and swelling varies from plant to plant. Some give higher percentage after drying. Shrinkage starts when cell walls of timber start to release water. In moist atmosphere, timber swells when cell walls absorb water. Good quality timbers swell less. Timber h ving thicker wall swell more than a thinner one.

(8) **Strength.** Best quality timber have the highest strength. Strength means capable to bear loads. Anisotropic material like timber has different structure at the different portion. So, the strength of timber is different at different points. Grain structure determines the strength of the timber. **Compressive strength** - 500 kg/cm$^2$ to 700 kg/cm$^2$ load is enough to test timbers strength. **Tensile strength** - When timber is enough strong to the tensile force. If perpendicular force is made then timber is weaker, 500-2000 kg/cm$^2$ is the range of tensile strength load. **Transverse strength** - Enough bending strength indicates good quality timber.

(9) **Density.** Timber having higher density have a thicker wall, high moisture content and presence of defects. There may be some of the natural and artificial defects in timber such as cross-grain, knots, and shakes, etc. All of them cause a decrease in the strength of the timber.

(10) **Toughness.** Timber has to have the capability to·bear shocks, jerk. Anti-bending and anti-splitting characteristic is needed. Old timber have annual rings which indicate their age is a good indicator.

(11) **Elasticity.** Elasticity means timber should attain its own shape after use. Because of this quality, it is used in sports bat.

(12) **Warping.** Environmental change with season can't effect good quality timber.

(13) **Durability.** A good quality timber has the property to resist the attack of fungus infection or other insects. This resistance quality makes timber better.

(14) **Defect less.** This property is gained if the timber is from a sound tree. A defect less tree is free from sap, shakes, and dead knots.

(15) **Workability.** A good timber is always easy to work on it. Easy to drag using saw on good timber. The finishing can be done well.

(16) **Soundness.** A good quality timber gives good sound.

(17) **Texture.** The texture of good timber is fine and even.

(18) **Free of Abrasion.** Timber should not be damaged by the external environment. It has to gain the ability to protect its skin.

6.5.1 Table 6-2 includes properties and uses of first Class timber for the guidance of executives.

**TABLE 6-2**

| Name | Color/ Texture | Density (lbs/cft) | Compressive/ Crushing Strength (psi) | Durability | WorkabIlIty | Properties | Uses |
|---|---|---|---|---|---|---|---|
| **Pakistani** | | | | | | | |
| **Sheesham** (sissoo) | • Golden/ reddish brown<br>• straight grained<br>• Medium to coarse texture | 48 | 8050 | Very high | Good | • Ring porous<br>• Strong<br>• moderate in bending strength & hardness<br>• smooth shiny finish<br>• Rosewood like smell<br>• Decay resistant | • Flooring<br>• Furniture, carving<br>• Cabinets<br>• Veneer, plywood<br>• Boat building<br>• Musical instruments |
| Walnut | • Sapwood greyish white<br>• Heartwood greyish brown<br>• Straight medium fine grained | 40-43 | 7580 | Average | Excellent | • Moisture resistant<br>• Moderate hardness<br>• Low bending strength<br>• Excellent finish with effort | • Flooring<br>• Wall paneling<br>• Furniture |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Deodar** (Cedar) | • Yellowish brown<br>• Straight grained<br>• Fine/ even texture | 35 | 6020 | Hig _ | Excellent | • Strong<br>• Moderately hard<br>• Rot / fungus resistant<br>• Non-porous<br>• Good finish<br>• Withstand high polishing<br>• Highly stable<br>• Resistant to warping & cracking | • Heavy construction work<br>• Doors & windows<br>• Wall paneling<br>• Plywood<br>• Railway carriages / sleepers<br>• Medicinal uses |
| **Imported** | | | | | | | |
| Teak (sagwan) | • Golden medium brown<br>• Straight grained<br>• Coarse uneven texture | 41-55 | 7940 | Very high | Excellent | • Strong<br>• Beautiful ornamental finish<br>• Moisture resistant<br>• Leather like smell<br>• Excellent decay & tennite resistant<br>• Attacked by marine borers | • Exterior construction<br>• Cabinets<br>• Veneer<br>• Wood working<br>• Furniture & carving<br>• Boat building, |
| **Ash** | • Heartwood light to medium brown.<br>• Straight grained<br>• Medium to coarse texture | 40-53 | 7410 | Below Average | Good | • Light weight<br>• Shock-resistant<br>• Beautiful finish<br>• Poor weather resistant<br>• Crack with age but elastic, hard & firm<br>• Suitable for polish<br>• Unpleasant smell<br>• Attacked by insects<br>• Steam bending | • Construction work<br>• Cabinets<br>• Flooring<br>• Wood working<br>• Furniture<br>• Molding work<br>• Sports goods |
| **Mahogany** | • Pale pinkish to reddish brown<br>• Straight to wavy grained<br>• Fine to medium texture | 31-53 | 6760 | Very high | Excellent | • Resilient<br>• Beautiful finish<br>• Weather resistant<br>• Odorless<br>• Stable<br>• Termite resistant<br>• Attacked by insects | • Furniture<br>• Cabinets<br>• Carving, sculpture<br>• Veneer<br>• Musical instruments |
| Beech | • Reddish brown<br>• Straight grained<br>• Fine even texture | 32-56 | 8270 | Below average | Good | • Odorless<br>• Absorb moisture<br>• Good finish<br>• Excellent bending<br>• Attacked by insects. | • Furniture<br>• Light construction work<br>• Not suitable for external/ humid climate<br>• Flooring<br>• Veneer<br>• Cabinets |
| Oak | • Golden light brown<br>• Straight grained<br>• Coarse uneven texture | 45-47 | 7370 | Very high | Good | • Resistant to insects & fungi<br>• High water resistant<br>• Shrinkage resistant<br>• Excellent finish | • Flooring<br>• Roof construction<br>• cabinets<br>• external cladding<br>• Wall paneling<br>• Veneer<br>• Furniture<br>• Boat building<br>• Aaricultural tools |
| Red Meranti | • Dark reddish brown<br>• Straight or interlocked. thin grained<br>• Coarse texture | 40-42 | 7070 | Below average | Good | • Finishes well<br>• Odorless<br>• Average quality<br>• Attacked by insects | • Chowkats<br>• Plywood<br>• Interior furniture<br>• Veneer<br>• Formwork<br>• Paneling |

## CONSTRUCTION REQUIREMENTS

**6.6. Fixing.** In addition to the item, detailed in definition of the General Rules, the term "fixed" shall include all laps, notching, halving, scraping etc, wrought, splayed, rounded notched and pointed ends of timbers, scribing, circular, cutting and boring for bolts as well as wire, hoop iron, coir, hemp or either approved ropes, previously dipped in anti-termite or preservative solution, for ballies.

**6.7. Re-Secure.** The term "Re-secure" provides for securing fitting, etc., which have become partially loosened, but which can be secured with holdfasts, plugs etc, without taking down.

**6.8. Taking up / Taking down.** The expression "taking up" or "taking down" including clearing out nails, etc. the expression "taking down existing trusses and re-hoisting and re-fixing the same" include tightening up wedges, cotters, bolts etc. Any work done on the trusses in addition to the foregoing shall be paid for separately, under the relevant rates.

**6.9. Plugging to Walls.** Rawal plugs or Phill plugs will invariably be used. Plugging to walls shall be at intervals not exceeding 200 mm for Rawal plugs and Phill plugs.

**6.10. Boarding.** Boarding shall be in width not exceeding 225 mm, except where in detached pieces as shelves etc. and in length not less than 2 M, unless circumstances make it impracticable.

**6.11. Flooring.** Boarding in flooring, ceiling etc., shall include cramping or wedging up punching nail and "cleaning off' after fixing. All heading joints are made on the center of joint bearers and no two heading joints to be adjacent. The boards to be nailed with steel cut brads (or oval brads) or fixed with screw, two to each board, on every joist of following lengths:-

| | | |
|---|---|---|
| (1) | For 25 mm or 30 mm flooring | 65 mm long |
| (2) | For 40 mm flooring | 75 mm long |
| (3) | For 50 mm flooring | 100 mm long |

## METHOD OF MEASUREMENT

**6.12. Timbering**

6.12.1 Measure the surface of excavation supported.

6.12.2 Timbering to excavation will only be carried out, when specially ordered by the Engineer-in-Charge.

6.12.3 Timbering, where ordered, include use and waste upto 6 months, fixing and removal.

6.12.4 Both sides of trenches will be taken as one side area, the Area will be equal to length x depth of timbering.

**6.13. Timbering Left In.** Measure the cubic contents of timber, planks, struts etc, left in.

**6.14. Tolerance**

6.14.1. Lengths shall be measured net.

6.14.2. Scantling, swan or wrought, shall hold full dimension.

6.14.3. Boarding shall hold the full thickness specified whether sawn or wrought.

6.14.4. Widths of single boards shall be measured net.

6.14.5. Widths of surfaces of two or more boards be measured net.

**6.15. Framed and Unframed Timbers** shall be measured out to out.

**6.16. Sallies.** The mean diameter of ballies is the sum of the dia at either end divided by two.

## CLARIFICATION OF RATES

**6.17.** The rates, inter alia, include particularly:-

(1) Beveled heading joints to boarding.

(2) Boring for bolts, as required.

(3) Cleaning of wrought faces.

(4) Cramping or wedging up.

(5) Fixing with hardwood or male bamboo pins, nails, spikes hoop iron and wire in any position.

(6) Labour and material in halving, tabling, lapping, notching, framing and straight, splay, circular or birds mouth cutting, splayed and beveled ends, miters, fair or turned ends, as required.

(7) Punching and clenching nails.

(8) Treating plugs with wood preservative.

(9) Waste.

(10) Boarding in any width.

(11) Work in First Class Softwood (Deodar) except where otherwise stated.

(12) All notching, firing or squaring, to ballies necessary to obtain level bedding, bearing of fixings.

(13) Rebates and chamfers to door and window frames where required.

(14) Chamfering mitering, edging etc., to fillets.

**6.18. In Addition.** The rates for "framed" include, for framing together with Mortice and Tenon or dovetailed joints, as in trimmer and trimming joists, roof trusses etc. and hoisting into position as may be necessary.

**6.19. Where a contractor supplies or is ordered to supply Second Class Softwood, following adjustments will be made to the rates.**

**"For item of Materials and Labour - Deduct 60%".**

**6.20.** Circular framed work shall be measured net and paid for at twice the rates for straight. All other irregular / circular work shall be measured to the smallest circumscribing rectangle and paid at normal rates.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) j |
|---|---|---|---|
| | **Wood Work** | | |
| 6-1 | Supply and fix **timber in scantling, 1st Class softwood (Deodar),** complete. | Cum | 192665 |
| 6-2 | Same as item 06-1, but **1st Class hardwood (Sheesham).** | Cum | 134018 |
| 6-3 | Supply and fix **timber in scantling framed, 1st Class softwood (Deodar),** complete, all as specified. | Cum | 203290 |
| 6-4 | Same as item 06-3, but **1st Class hardwood (Sheesham).** | Cum | 144287 |
| 6-5 | Supply and fix, **timber in scantling wrought and framed, 1st Class softwood (Deodar),** complete. | Cum | 203385 |
| 6-6 | Same as item 06-5, but **1st Class hardwood (Sheesham).** | Cum | 146838 |
| | **Fillets** | | |
| 6-7 | Supply and fix, **fillets** not exceeding 12.90sqcm sectional area of **1st Class softwood (Deodar)** wrought and fixed with screws. | Metre | 210 |
| 6-8 | Same as item 06-7, but **1st Class hardwood (Sheesham).** | Metre | 164 |
| 6-9 | Supply and fix fillets exceeding 12.90 sqcm but not exceeding 25.80 sqcm sectional area of **1st Class softwood (Deodar),** wrought and fixed with screws. | Metre | 346 |
| 6-10 | Same as item 06-9, but **1st Class hardwood (Sheesham).** | Metre | 265 |
| 6-11 | Supply and fix fillets exceeding 25.80 sqcm but not exceeding 38.70 sqcm in sectional area of **1st Class softwood (Deodar),** wrought and fixed with screws. | Metre | 539 |
| 6-12 | Same as item 06-11, but **1st Class hardwood (Sheesham).** | Metre | 396 |
| | **Boarding** | | |
| 6-13 | Supply and fix, **chipboard** (600 density), **13 mm thick.** | Sqm | 700 |
| 6-14 | Same as item 06-13, but **19 mm thick.** | Sqm | 840 |
| 6-15 | Same as item 06-13, but **25 mm thick.** | Sqm | 1051 |
| 6-16 | Supply and fix, **ply wood 3 mm thick commercial ply** in any position. | Sqm | 587 |
| 6-17 | Same as item 06-16, but **Sheesham ply.** | Sqm | 604 |
| 6-18 | Same as item 06-16, but **Teak ply.** | Sqm | 643 |
| 6-19 | Add to item 06-16, 06-17, and 06-18, if fixed in repairs. | Sqm | 66 |
| 6-20 | Supply and fix **19 mm thick Chip board** veneered both sides of specified pattern in any position Commercial. | Sqm | 1228 |
| 6-21 | Same as item 06-20, but **Sheesham veneered.** | Sqm | 1228 |
| 6-22 | Same as item 06-20, but **Teak veneered.** | Sqm | 1291 |
| 6-23 | Supply and fix **10 mm thick MDF laminated sheet** of specified pattern in any position. | Sqm | 923 |
| 6-24 | Same as item 6-23 but **16 mm thick** all as specified. | Sqm | 1367 |
| 6-25 | Same as item 6-23 but **24 mm thick** all as specified. | Sqm | 2158 |
| | **Old Roof Trusses** | | |
| 6-26 | Taking down, old timber trusses upto 8 M span. | Each | 1440 |
| 6-27 | Same as item 06-26, but exceeding 8M, not exceeding 11 M span. | Each | 2100 |
| 6-28 | Hoisting and fixing old timber trusses upto 8 M span. | Each | 2820 |
| 6-29 | Same as item 06-28, but exceeding 8M and not exceeding 11 M span. | Each | 3480 |
| | **Trellis Work** | | |
| 6-30 | Supply and fix 40 mm x 10 mm first class soft wood (Deodar), wrought trellis work two way, square or diagonal at 50 mm space and 75 mm x 25 mm fillet framing all around fixed, complete. | Sqm | 4558 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Moulding and Turned work** | | |
| 6-31 | Supply and fix **1st Class softwood (Deodar),** moulding and turned work exceeding 75 mm but not exceeding 150 mm, 25 mm thick. | Metre | 600 |
| 6-32 | Same as item 06-31, but 40 mm thick. | Metre | 1060 |
| 6-33 | Same as item 06-31, but 50 mm thick. | Metre | 1330 |
| | **Workmanship, Plugging etc.** | | |
| 6-34 | Labour only beads, chamfers, splay, rebate, rounded angles, tongues, grooves, rounded nosings, staff beads, flutes, each exc. 6mm and not exceeding 75 mm width or girth, mouldings and turned work not exceeding 75mm girth, where not otherwise provided. Rate per 25 mm turned girth or part thereof, **1st Class softwood (Deodar).** | Metre | 198 |
| 6-35 | Same as item 06-34, but **1st Class hardwood (Sheesham).** | Metre | 231 |
| 6-36 | Supply and fix Rawal plug 25 mm long for boards etc. not exceeding 200 mm c/c (in any wall, in any mortar or concrete) | Metre | 85 |
| 6-37 | Same as item 06-36, but 50mm long. | Metre | 86 |
| | **Jobbing Work for all items in 1st Class soft wood (Deodar)/ hard wood (Sheesham)** | | |
| 6-38 | Resecuring of wire gauze (fly and mosquito netting with fillet and or framing), hard/ soft wood. | Sqm | 114 |
| 6-39 | Taking up or down and refixing of wire gauze (fly and mosquito netting with fillet and / or framing), hard/ soft wood. | Sqm | 180 |
| 6-40 | Taking up or down wire gauze (fly and mosquito netting with fillets and / or framing) and removing to store, (hard/ soft wood). | Sqm | 66 |
| 6-41 | Taking up or down and refixing of shelves including brackets, fillets and window board with beads etc., (hard/ soft wood). | Sqm | 213 |
| 6-42 | Taking up or down shelves including brackets, fillets and window boards with beads etc., and removing to store (hard/ soft wood). | Sqm | 99 |
| 6-43 | Taking up or down and refixing of skirting wood, any width includi g grounds if required, (hard/ soft wood). | Sqm | 213 |
| 6-44 | Taking up or down skirting wood, any width including grounds and removing to store, (hard/ soft wood). | Sqm | 66 |
| 6-45 | Taking up or down and refixing boarding flooring in area not exceeding 4.65 sqm super, (hard/ soft wood). | Sqm | 278 |
| 6-46 | Same as item 06-45 but in patches, in repairs to existing floors, including cutting to joints etc., (hard/ soft wood). | Sqm | 327 |
| 6-47 | Re-securing of casings (box) to pipes, any girth, (hard/ soft wood). | Sqm | 66 |
| 6-48 | Taking up or down and refixing of casing (box) to pipes any girth, (hard / soft wood). | Metre | 132 |
| 6-49 | Taking up or down and removing to store of casing (box) to pipes any girth, (hard/ soft wood). | Metre | 33 |
| 6-50 | Re-securing of fillets, mouldings, quadrant skirting, hand rails, peg rails, etc, (hard/ soft wood). | Metre | 72 |
| 6-51 | Taking up and down and refixing of fillets, mouldings, quadrant skirting, hand rails, peg rails, etc., (hard/ soft wood). | Metre | 105 |
| 6-52 | Taking up or down fillets, moldings, quadrant skirting, hand rails, peg rails etc., and removing to store, (hard/ soft wood). | Metre | 33 |
| 6-53 | Taking up or down and refixing of scantling in any position, (hard / soft wood). | Cum | 9000 |

SECtION-7

# DOORS AND WINDOWS

## RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-7

# DOORS AND WINDOWS

## SPECIFICATIONS

**7.0.** This section covers all operations regarding fabrication and erection of wooden joinery, cabinets, vinyl, aluminum, steel doors and windows etc., including hardware and preservatives.

### MATERIAL REQUIREMENTS

**7.1. Timber.** For specifications and classification of timber, Refer Section - 6 "Wood Work".

**7.2. Frames or Chowkats** Door and window chowkats, transoms and mullion shall be rebated of the dimensions shown below without horns:-

| | | |
|---|---|---|
| (1) | Openings under 1.11 Sqm | 75 mm x75mm |
| (2) | Openings 1.11 Sqm and over but not exceeding 2.60 Sqm | 75 mm x 100 mm |
| (3) | Openings 2.60 Sqm and over | 100 mm x 125 mm |

**7.3. Joints.** The joints in framed and halved joinery, to be pinned with hardwood pins and put together with glue. Framed means Mortice and Tenon or Dovetailed joints.

**7.4. Sashes**

7.4.1. The term **"sashes"** includes casements, single or double fixed, sliding or hung, and clerestory windows (centre, top or bottom hung or fixed).

7.4.2. Sashes shall be wrought, framed, squared, chamfered or moulded, with or without bars and rebated for glass or wire gauze. Styles and rails shall not be less than 65 mm wide. When fixed, means with screws.

**7.5. Glass.** Glass shall be clear, 3 mm or 5 mm thick, ordinary glazing quality, as specified. The glass shall be fixed in oil putty well bedded, back puttied and sprigged where necessary, or with hard wood /soft wood beads, as directed. Hard wood beads will be used for hard wood doors and windows, invariably.

**7.6. Medium Density Fibre (MDF) Board.** It shall follow BS EN 622 Density 600 to 800 Kg /Cum and sealing as per architectural design.

**7.7. Screws.** For specifications, Refer Section - 6 "Wood Work".

**7.8. Wire gauze.** Wire gauze shall be (iron tinned Fly wire 9 x 9 mesh x 22 or 24 gauge, iron or aluminium mosquito wire gauze 16 x 16 mesh x 26 gauge or 18 x 18 mesh x 28 gauge, fixed in rebate of wooden frames and secured with fillets, braded in or fixed with flat iron to steel frame, with screws.

### CONSTRUCTION REQUIREMENTS

**7.9. Wooden Doors**

7.9.1. **Panelled Doors.** Typical drawing of panelled door is shown in Figure 7-1. The frame consists of solid wood which is to be wrought, squared, framed and flat or chamfered or moulded one or both sides. Bottom rails be 150mm wide and other rails and styles 100mm wide. Panels shall not be less than 15mm thick. The panels can either be of 1st class soft or hard wood or MDF.

7.9.2. **Framed Panelled Partitions and Dados.** As per Para 7.9.1 above, the through styles shall not be more than one metre apart.

7.9.3. **Glazed Doors.** The panelled doors may either be full glazed or half glazed. The frames are similar to section 7.9.1 except for the top or bottom rail (as applicable) which should be as for sashes.

7.9.4. **Flush Doors**

7.9.4.1. **Hollow Flush Door.** Its shutter shall have frame and core of **1st Class Soft wood (Deodar),** treated with termite proofing agent and fixed on both sides with 3mm thick veneer of Teak/ Sheesham / Commercial ply. The shutter shall be either procured from a proprietary manufacturing firm, as approved by the Engineer-in-Charge or manufactured at site according to the established techniques (including machine pressing). The make-up of the shutter shall be as specified in Figure 7-2. Inspection shall be carried out by the Engineer-in-Charge before pressing.

7.9.4.2. **Solid Flush Door.** Its shutter shall have internal core and frame made of **1st Class Soft wood (Deodar)** treated with Termite proofing agent, veneered on both sides with 3 mm thick Teak **/** Sheesham / Commercial ply or equivalent jacket **/** skin, all as approved.

7.9.4.3. **Tubular Particle Board Door.** Its shutter frame of spource soft wood. The inner frame comprise Tubular particle board surrounded by frame 80mm x 30 mm spource wood. The covering sheet on both sides be

3.2 mm HOF with 0.2 mm Ash wood veneer with lacquer Polish, Colour as approved by the Engineer-in-Charge. The makeup of the shutter shall be as specified in Figure 7-3. Inspection shall be carried out by the Engineer-in-Charge before pressing.

7.9.5. **Miscellaneous**

7.9.5.1 **Hinges.** Doors exceeding 1.4 M height shall be fixed with Four (4) Butt hinges to each leaf.

7.9.5.2. **Holdfasts.** Doors, windows and CSW frames shall be fixed with 230mm long hold fasts, made of flat iron 25 mm x 3 mm thick with forked ends, tarred, sanded and fixed with two (2) screws 65mm long to frame respectively.

7.9.5.3. **Preservatives.** Back of door and window frames or chowkats shall be treated with one coat of Tar or equivalent material as described before fixing. Internal surface of steel chowkats be treated with anti-Creosote paint.

7.9.5.4. **Mongery.** Shall be provided to doors and windows as shown in Table 7-1, except where, otherwise described.

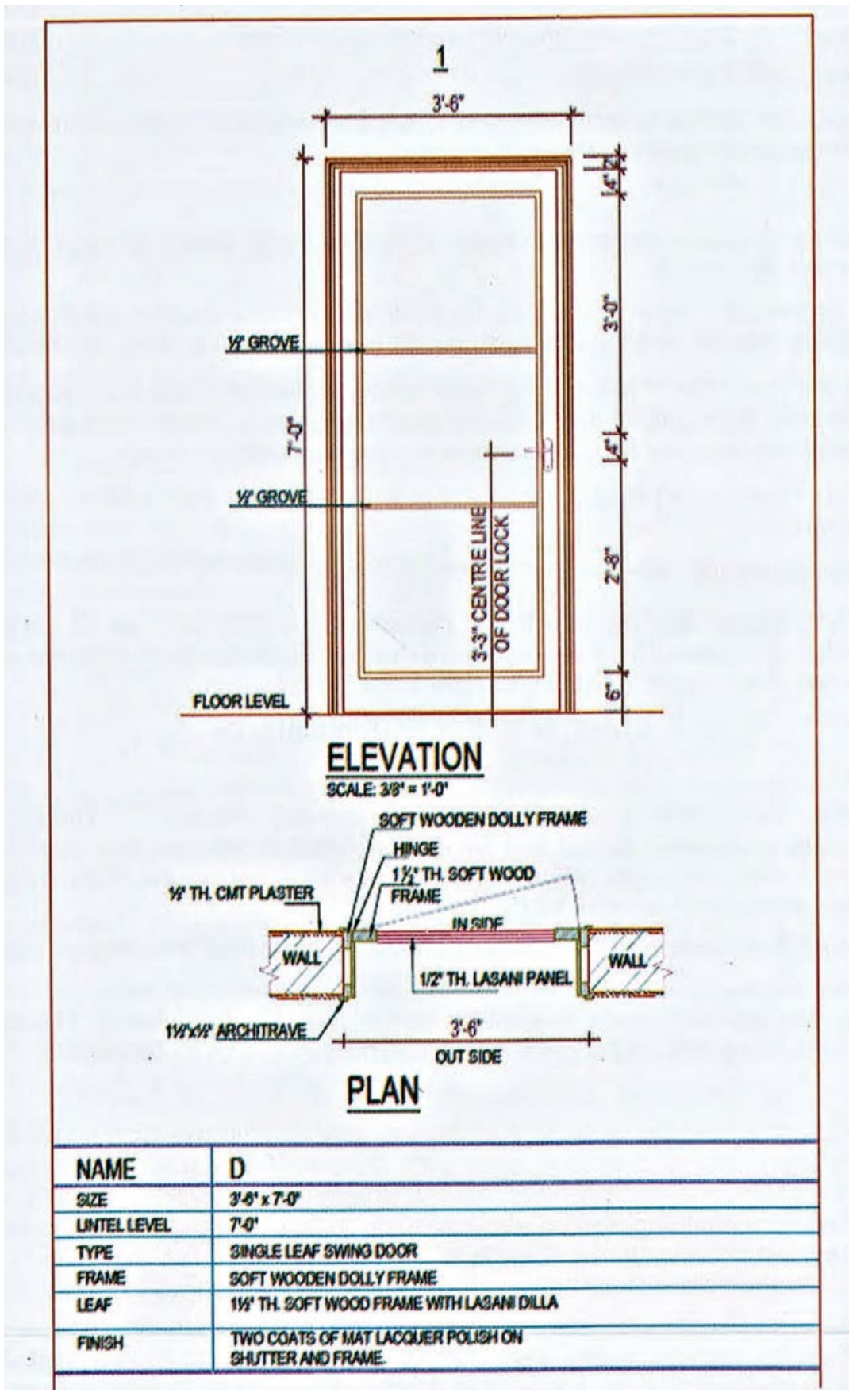



FIGURE 7-1 : TYPICAL PANELLED DOOR

TABLE 7-1

| Description | Unit | Door | | Opening Windows | | |
|---|---|---|---|---|---|---|
| | | Double Leaf | Single Leaf | Double Leaf | Single Leaf | Clerestory Pivot hung |
| Steel Butt Hinges (125 mm) | Nos | 8 | 4 | - | - | - |
| - do- (100 mm) | Nos | - | - | 4 | 2 | - |
| Pivots & Sockets (57 mm) | Sets | - | - | - | - | 2 |
| Tower Bolts (200 mm) | Nos | 1 | 1 | - | - | - |
| -do- (150 mm) | Nos | 2 | 1 | 1 | 1 | - |
| - do- (100 mm) | Nos | - | - | 2 | 1 | - |
| Bow handle (150 mm) | Nos | 3 | 2 | 1 | 1 | - |
| Softwood chocks (125 mm x 50 mm x 75mm) | Nos | 2 | 1 | 2 | 1 | - |
| Magnetic door stopper | Nos | 2 | 1 | - | - | - |

7.9.5.5. **Fixing etc.** In addition to the items, detailed in definition under miscellaneous, the term "fixed" shall include all laps, notching, halving, scarifying etc. and boring for bolts.

7.9.5.6. The term **"Re-secure"** provides for securing fitting etc., which has become partially loosened, but which can be secured without taking down and shall include cost of any subsidiary materials, required for re-securing.

7.9.5.7. The expression **"taking up"** or **"taking down"** includes clearing out nails, etc.

7.9.5.8. The expression "in **other openings"** includes cutting to size and fixing in openings.

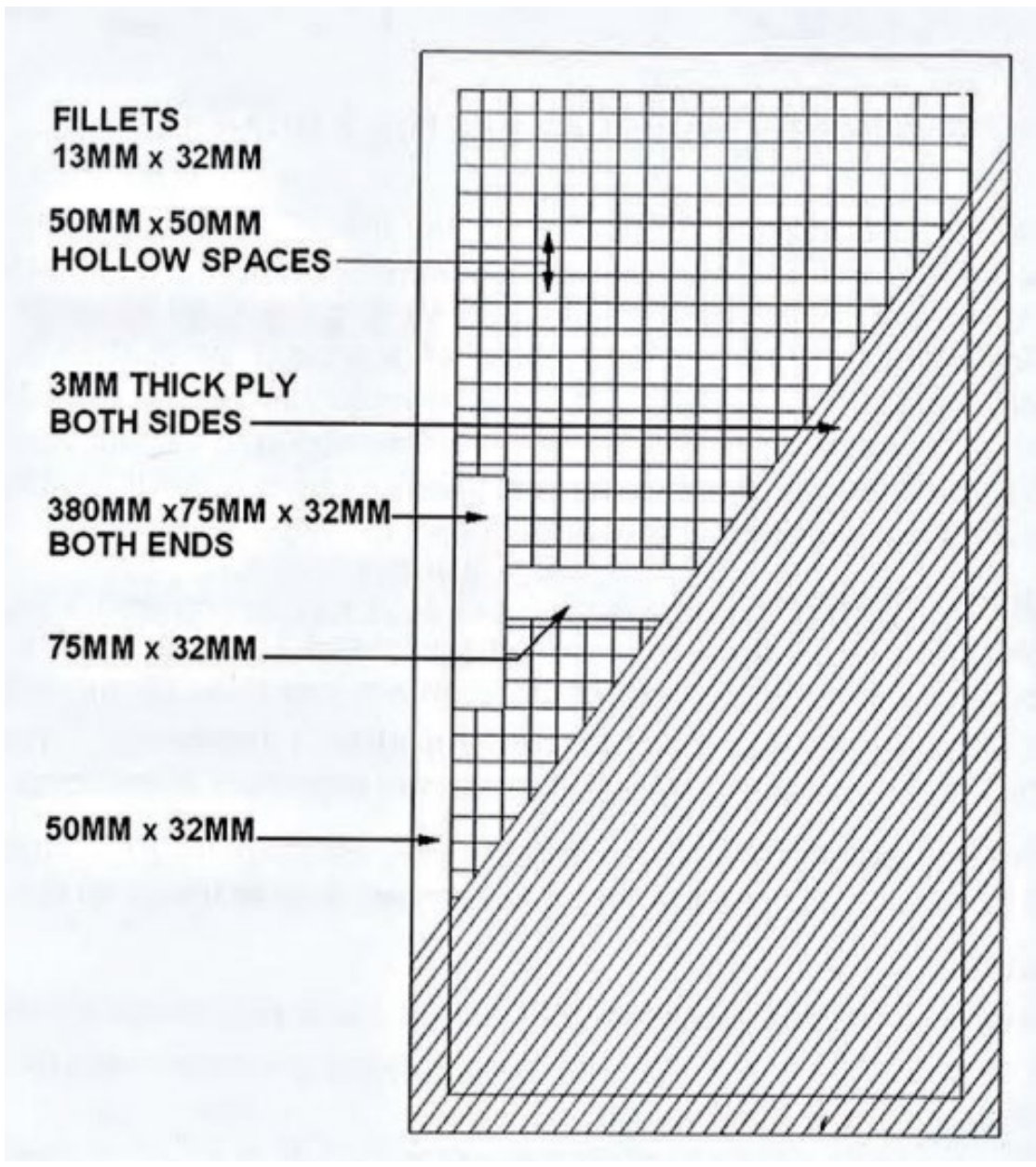



FIGURE 7-2 : HOLLOW FLUSH DOOR (38 MM THICK)

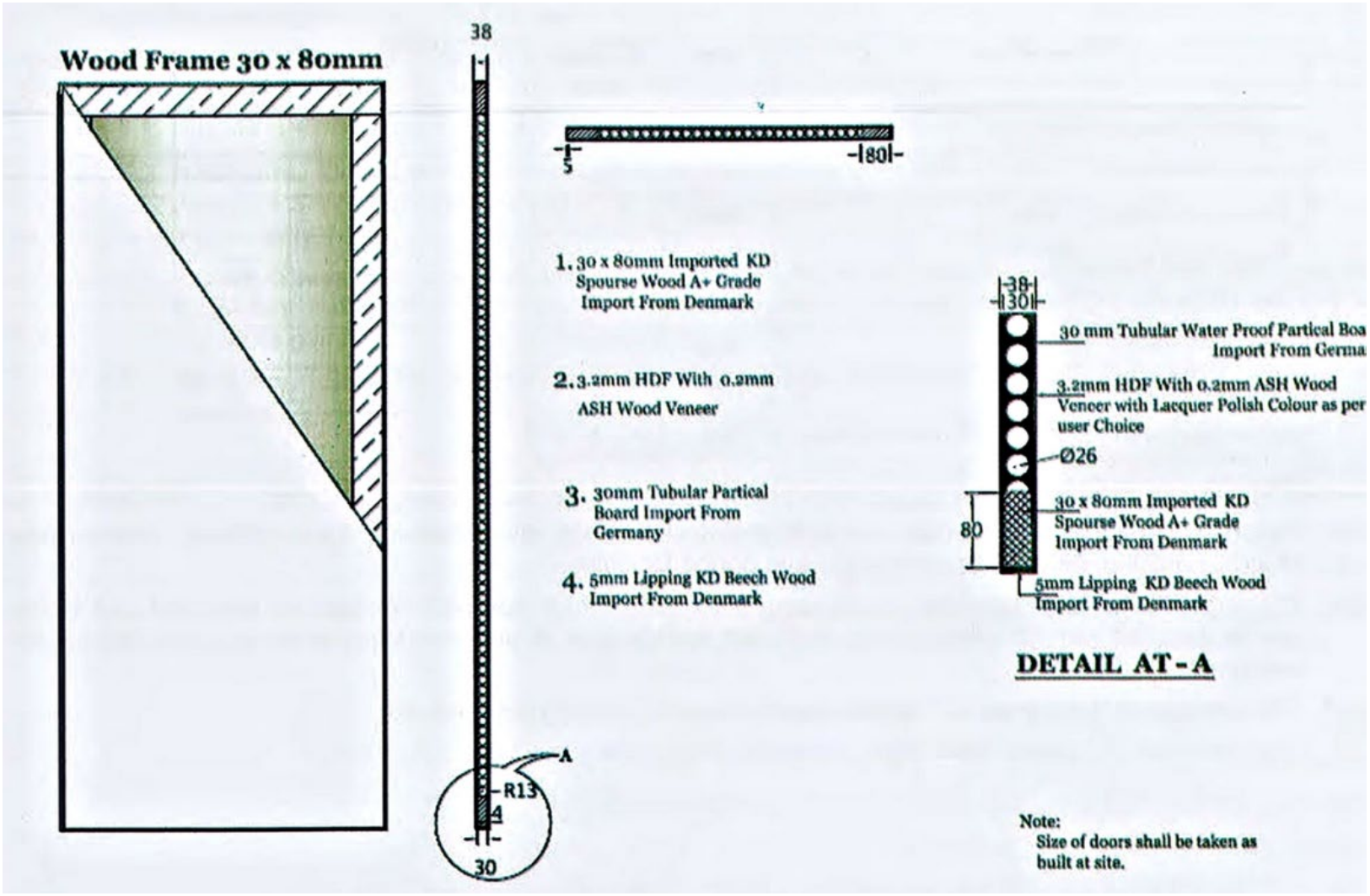

Wood Frame 30 x 80mm
38
5
80
1. 30 x 80mm Imported KD Spourse Wood A+ Grade Import From Denmark
2. 3.2mm HDF With 0.2mm ASH Wood Veneer
3. 30mm Tubular Partical Board Import From Germany
4. 5mm Lipping KD Beech Wood Import From Denmark
A
R13
4
30
38
30
30 mm Tubular Water Proof Partical Boa
Import From Germa
3.2mm HDF With 0.2mm ASH Wood Veneer with Lacquer Polish Colour as per user Choice
Ø26
80
30 x 80mm Imported KD Spourse Wood A+ Grade Import From Denmark
5mm Lipping KD Beech Wood Import From Denmark
DETAIL AT - A
Note:
Size of doors shall be taken as built at site.

**FIGURE 7-3: TUBULAR PARTICLE BOARD DOOR**

**7.10. Aluminium Doors and Windows.** These shall be made of extruded sections of Aluminium alloy conforming to International standards for alloy, quality and extrusion. The styles shall be joined by standard self-tapping or stainless steel screws. Special nylon rollers with steel galvanised housing and inner be incorporated with anti-friction bearing for sliding of leaves. One piece of standard latch shall be provided in the window enabling it to be locked from inside. Door leaf should be removable from inner side of the frame for easy glazing and cleaning. Vinyl bead shall be used for setting of glass and sealed with silicon, where necessary. All extruded sections shall be anodized (thickness in microns as specified) to give natural aluminum of any colour, texture finish as required and provide a non-wearing and weather proof oxide coating.

7.10.1. **Sliding / Swing Doors/ Windows**

7.10.1.1. **Deluxe Model (Aluminium Natural / Coloured Anodized/Textured).** The wall thickness of frame and leaves shall not be less than 1.6 mm and anodization not less than 15 microns.

7.10.1.2. **Premium Model (Aluminium Natural/Coloured Anodized/ Textured).** The wall thickness of frame and leaves shall not be less than 2 mm and anodization not less than 25 microns.

7.10.2. **Fly Screen.** The Aluminium Fly/ Insect screen shall be made from aluminium, having frame 42 mm x 13 mm /16 x 16 mesh and be rust-proof. The frames of the screen should match to the windows.

7.10.3. **Standard Hardware**

7.10.3.1. **Hinges.** The swing door shall be provided with hinges made of Stainless steel.

7.10.3.2. **Handles.** These shall be 100 mm x 225 mm, having good grip and made of Aluminium extruded sections with matching finish.

7.10.3.3. **Locks.** Door/ window locks will be provided as per approval of Engineer-in-Charge.

7.10.3.4. **Materials.** Aluminium sections shall be extruded Aluminium Alloy billets of AA 6063 conforming to ASTM B-221 (equivalent to HE 9 of BSS 1474) metal grade, having the following composition:-

| | | |
|---|---|---|
| (1) | Aluminium not less than | 95.50% |
| (2) | Iron, not more than | 0.35% |
| (3) | Silicon | 0.20 to 0.60% |
| (4) | Magnesium | 0.45 to 0.90% |

**7.11. Engineered Doors and Windows.** The engineered doors and windows are made up of innovative materials like uPVC, Green technologies (environmental friendly) and compressed wood etc. Fire rated doors will also be categorized as engineered doors. The manufacturers of such doors / windows shall be from approved list of E-in-C Branch and integrated into overall building designs.

**7.12. Steel Chowkats.** Steel Chowkats shall conform to the specifications shown in Figure 7-4 (115mm Wall, Single Leaf), Figure 7-4a (230mm/242mm Single Leaf) and Figure 7-4b (230mm/242mm Double Leaf).

**7.13. Kitchen Cabinets.** Refer to details in Figure 7-5, as per Information Sheet No. IS - ARCH 17 to 19, Volume - I (Revised 2014). The details are as under:-

(1) **Frame.** First Class Soft wood (Deodar), 25 mm x 38 mm.

(2) **Shutter and Shelves.** 19mm thick, MDF, Laminated board, PVC/ UV board etc.

(3) **Floor.** As specified in drawings.

(4) **Counter Slab.** As specified in drawings.

(5) **Drawer.** First Class Soft wood, 19mm thick sides and back with 19mm thick Teak Vin board on front, and 5mm thick MDF board provided with sliding rails.

(6) **Wall and Skirting.** Glazed tiles.

(7) **Sink.** Stainless steel sink, supported on brick walls

(8) **Internal Wall finishes.** Plaster, 13 mm thick, on brick walls

(9) **Exhaust Hood.** Made of Teak Vin board with 22 gauge PGI sheet fixed on inner side and Electric Hood.

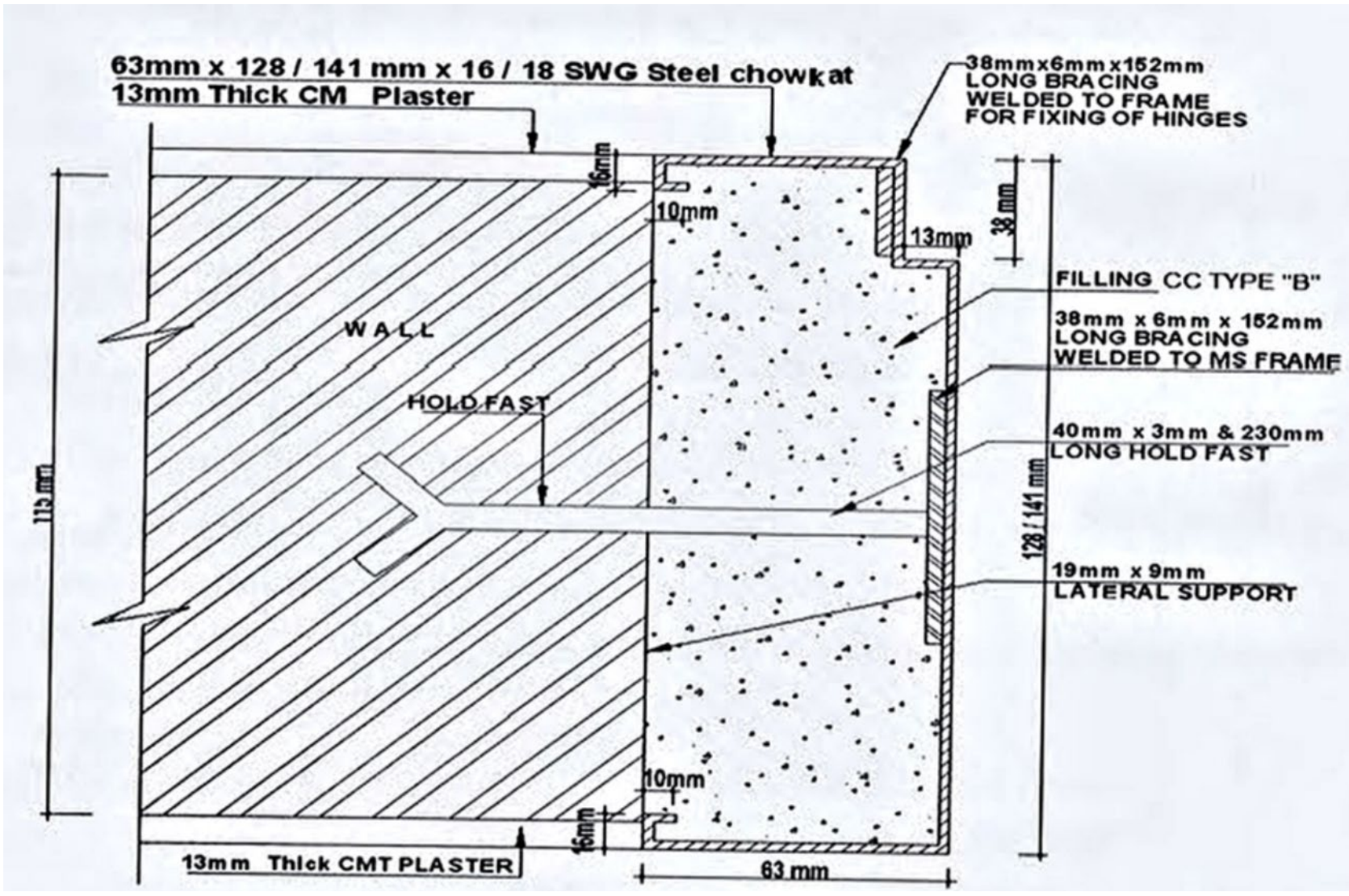

63mm x 128 / 141 mm x 16 / 18 SWG Steel chowkat
13mm Thick CM Plaster
38mmx6mmx152mm LONG BRACING WELDED TO FRAME FOR FIXING OF HINGES
16mm
10mm
13mm
38 mm
FILLING CC TYPE "B"
38mm x 6mm x 152mm LONG BRACING WELDED TO MS FRAME
WALL
HOLD FAST
40mm x 3mm & 230mm LONG HOLD FAST
115 mm
128 / 141 mm
19mm x 9mm LATERAL SUPPORT
10mm
16mm
13mm Thick CMT PLASTER
63 mm

FIGURE: 7-4
STEEL MOULDED CHOWKAT FOR 115MM THICK WALL (SINGLE LEAF)

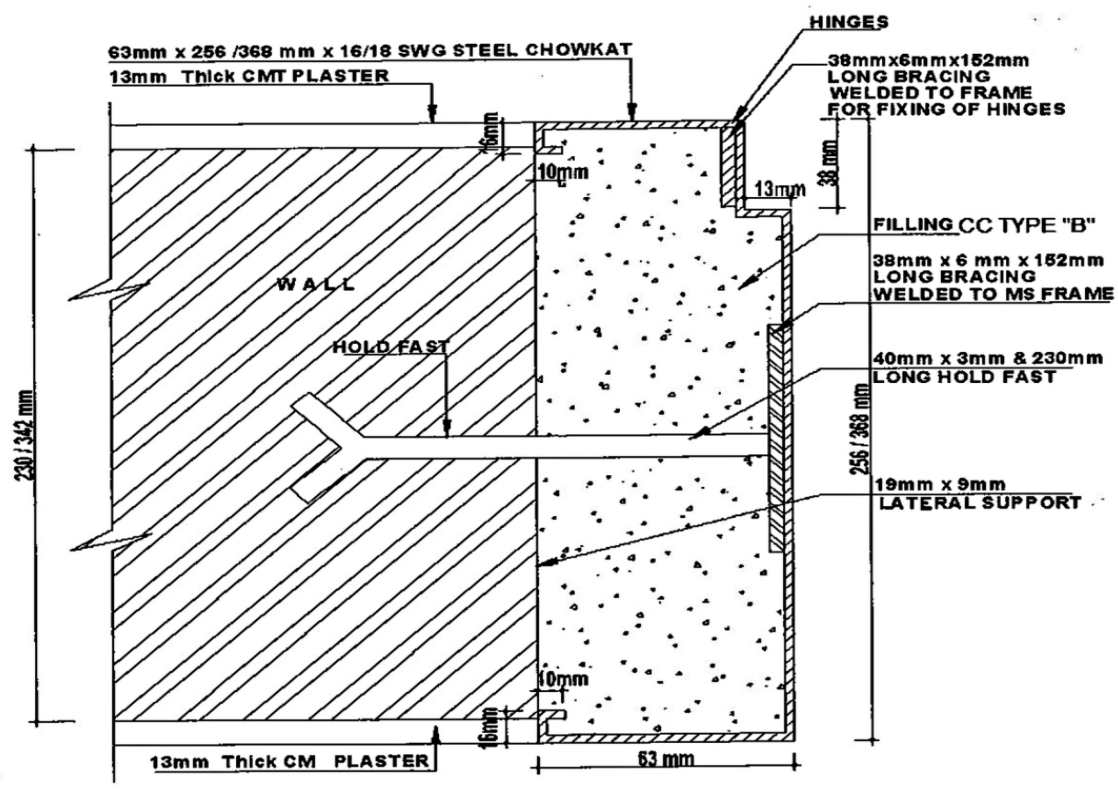



**FIGURE : 7-4a**
**STEEL MOULDED CHOWKAT FOR 230/342MM THICK WALL (SINGLE LEAF)**

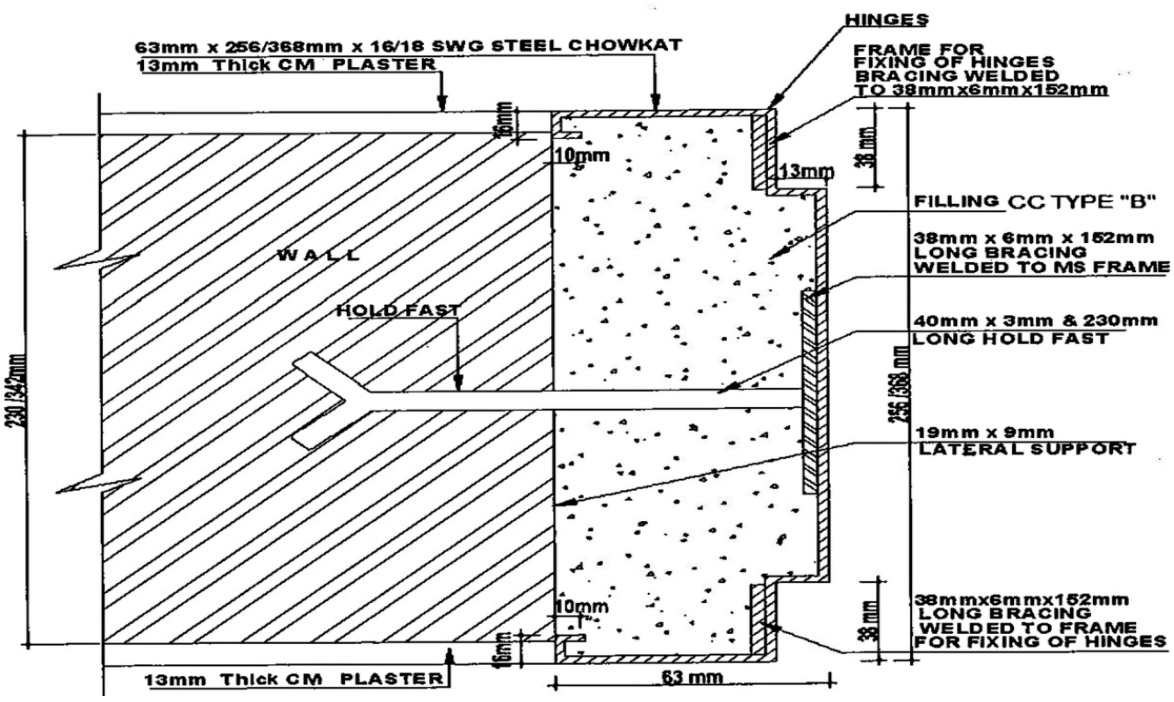



**FIGURE: 7-4b**

**STEEL MOULDED CHOWKAT FOR 230/342MM THICK WALL (DOUBLE LEAF)**

## METHOD OF MEASUREMENTS

**7.14.** Following shall be considered while taking measurements:-

(1) **Tolerances.** Thickness will be dead, as shown in each item. No tolerance, plus or minus will be admissible.

(2) **Clench Nailing.** No extra allowance shall be made, where clench nailing is specified, but screws are used.

(3) **Doors & Windows.** To be measured overall, including frames or chowkats. Circular and curved portions shall be measured as square and paid for at twice the ordinary rates (segment only to be measured).

(4) **Mitered Pieces.** Each piece shall be measured over all.

(5) **Door Partly Panelled Sashed.** The glazed portion shall be measured separately as a sash. The dividing line shall be the middle of the rail below the glazing.

(6) **Aluminium Doors and Windows.** To be measured overall including frames. Arched portions be measured as square by measuring, base and rise.

(a) Fixed portion with sliding window be treated as sliding rates.

(b) Fan light fixed portion up to 450mm high of Aluminium sliding windows doors/ swing doors be treated as sliding/ swing and paid accordingly.

(c) Exceeding 450 mm high (Fixed portion) of Aluminium sliding windows/ doors / swing doors be treated as fixed and paid accordingly.

(7) **Engineered Doors/ Windows.** To be measured overall including frames. Arched portions shall be measured as square by measuring, base and rise.

(8) **Box Steel Windows.** Measured overall including frames.

(9) **Kitchen Cabinet.** Length of floor cabinet, sink cabinet, wall cabinet and exhaust hood shall be measured.

## CLARIFICATION OF RATES

**7.15.** The rates, inter alia, include particularly:-

(1) Work in First Class Soft wood, as defined, except where otherwise stated.
(2) Fitting and fixing or hanging, as indicated.
(3) Nails, screws, wedging and keys as required.
(4) First Class Hard wood or bamboo pins for framed joints.
(5) Boring for bolts.
(6) Arises or chamfers 6 mm wide as required.
(7) Mitres, stops, fair or turned end, etc.
(8) All cutting and wastes.
(9) Fixing gauze with wooden beads and glass with bead and oil putty.
(10) Fixing of springs, beads and brads.
(11) Frames or chowkats to door and windows with holdfasts.
(12) Mongery to doors and windows as listed in Table 7-1.

**7.16.** The rates for sashes also include:-

(1) Glazing with 3mm or 5mm thick glass or wire gauze (fly or mosquito wire) as specified.
(2) Fixing with screws or nails, or preparing for hanging with hinges, pivots etc.

**7.17. Where Second-Class softwood is u·sed, the rates for "material and labour" shall be reduced by 60%.**

**7.18.** . Mongery supplies in addition to that listed in specification will be paid extra at the "Supply and Fix " rates and vice versa.

**7.19.** Wood Preservatives, except as specified in Para 7.9.5.3 and 7.9.5.4, and painting will be paid extra.

**7.20.** Rates of Kitchen cabinet etc. do not include cost of sink, mixer, cooking range and glazed tiles etc.

**7.21.** Rates of Engineered doors and windows:-

7.21.1. The rates include items of joinery, mongery and fixing of doors and windows complete.

7.21.2. Glazing will be paid separately.

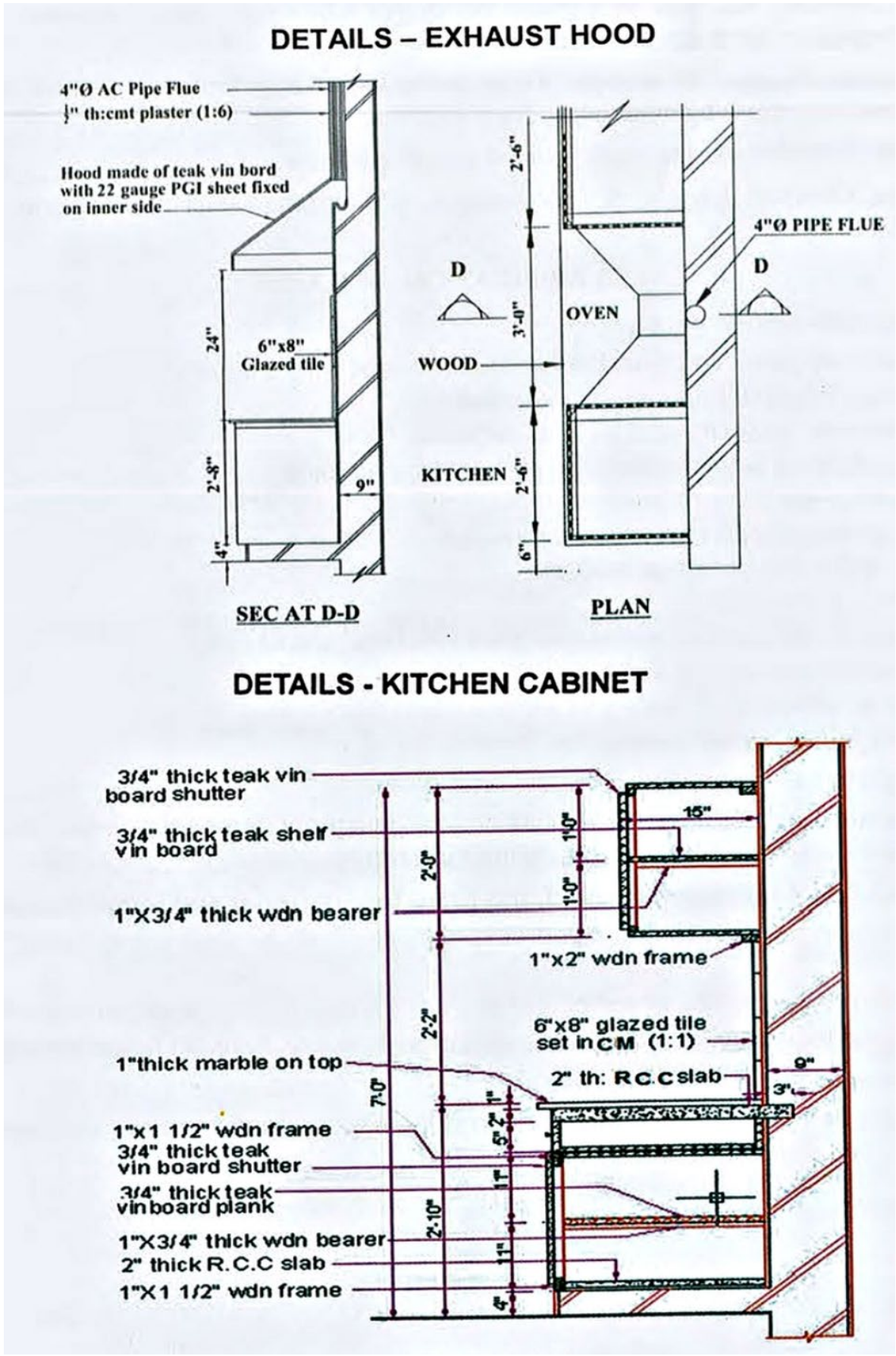



FIGURE: 7-5

As per Information Sheet# IS-ARCH 17 to 19, Volume-I (Revised 2014)

**ITEM RATES**

| SINo | Descrietion | Unit | Rate {Rs}I |
|---|---|---|---|
| | **Solid Wooden Doors** | | |
| 7-1 | Supply and fix, **1st Class Soft Wood (Deodar) Framed and Panelled Doors,** gates etc., including chowkats, hold fasts, and mongery, all as specified, **32 mm thick.** | Sqm | 13763 |
| 7-2 | Same as item 7-1, but **38 mm thick.** | Sqm | 14808 |
| 7-3 | Supply and fix, **1st Class Hard Wood (Ash wood) Framed and Panelled Doors,** gates including chowkats, hold fasts and mongery, all as specified, **32** mm **thick.** | Sqm | 19826 |
| 7-4 | Same as item 7-3, but **38 mm thick.** | Sqm | 20514 |
| 7-5 | Supply and fix, **1st Class Hard Wood (Mahogany) Framed and Panelled Doors,** gates etc., including chowkats, hold fasts and monger, all as specified, **32 mm thick.** | Sqm | 19562 |
| 7-6 | Same as item 7-5, **but 38 mm thick.** | Sqm | 20239 |
| 7-7 | Supply and fix, **1st Class Hard Wood (Sheesham) Framed and Panelled Doors,** gates etc. including chowkats, hold fasts and mongery, all as specified, **32 mm thick.** | Sqm | 12771 |
| 7-8 | Sameasitem 7-7, but **38 mm thick.** | Sqm | 13724 |
| 7-9 | Deduct from item 7-1 and 7-2, if **chowkat 1st Class Soft wood (Deodar)** not supplied and fixed. | Sqm | 4675 |
| 7-10 | Deduct from item 7-3, 7-4, 7-5, and 7-6 if **chowkat 1st Class Hardwood (Ashwood/ Mahogany)** not supplied and fixed. | Sqm | 7099 |
| 7-11 | Deduct from item 7-7 and 7-8, if **chowkat 1st Class Hardwood (Sheesham)** not supplied and fixed. | Sqm | 4100 |
| | **Glazed/ Gauzed Doors** | | |
| 7-12 | Supply and fix, **1st Class Soft Wood (Deodar), Glazed doors,** with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and hung with hinges or pivots and mongery all as specified, **32 mm thick.** | Sqm | 12927 |
| 7-13 | Same as item 7- 12, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 13211 |
| 7-14 | Same as item 7-12, but **38 mm thick.** | Sqm | 13280 |
| 7-15 | Same as item 7-14, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 13224 |
| 7-16 | Deduct from item 7-12 to 7-15, if chowkats not supplied and fixed. | Sqm | 7264 |
| 7-17 | Supply and fix, **1st Class Hard Wood (Ash wood), Glazed doors** with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and hung with hinges or pivots and mongery all as specified, **32 mm thick.** | Sqm | 18630 |
| 7-18 | Same as item 7-17, but gauzed, 9x9 mesh, 24 BG. | Sqm | 18507 |
| 7-19 | Same as item 7-17, but **38 mm thick.** | Sqm | 19186 |
| 7-20 | Same as item 7-19, but gauzed, 9x9 mesh 24 BG. | Sqm | 19156 |
| 7-21 | Deduct from item 7-17 to 7-20, if chowkats not supplied and fixed. | | 10023 |
| 7-22 | Supply and fix, **1st Class Hard Wood (Mahogany), Glazed doors** with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and hung with hinges or pivots and mongery all as specified, **32 mm thick.** | Sqm | 17381 |
| 7-23 | Same as item 7-22, but gauzed 9x9 mesh 24 gauge. | Sqm | 17339 |
| 7-24 | Same as item 7- 22, but **38 mm thick.** | Sqm | 18066 |
| 7-25 | Same as item 7-24, but gauzed 9x9 mesh 24 BG. | Sqm | 18527 |
| 7-26 | Deduct from item 7-22 to 7-25, if chowkats not supplied and fixed. | Sqm | 9854 |
| 7-27 | Supply and fix **1st class Hard Wood (Sheesham), Glazed doors** with moulded or chamfered bars, angels filled in with glass including chowkats, holdfasts hung with hinges or pivots and mongery all as specified, **32 mm thick.** | Sqm | 11855 |

| Sl No | Description | Unit | Rate {Rs}l |
|---|---|---|---|
| 7-28 | Same as item 7-27, but gauzed, 9X9 mesh, 24 BG. | Sqm | 11832 |
| 7-29 | Same as item No 7-27, but **38 mm thick.** | Sqm | 12532 |
| 7-30 | Same as item 7-29, but gauzed, 9x9 mesh, 24 BG. | Sqm | 12511 |
| 7-31 | Deduct from item 7-27 to 7- 30, if **chowkats** not supplied and fixed. | Sqm | 5410 |
| 7-32 | Deduct from item 7-13, 7-15, 7-18, 7-20, 7-23, 7-25, 7-28, and 7-30, if **mosquito proof gauze,** 16 x 16 mesh, 26 gauge is used. | Sqm | 561 |
| 7-33 | Supply and fix, **1st Class Soft Wood (Deodar) Framed and Panelled doors,** gates etc., **panels filled with MDF 16 mm sheet,** including chowkats, hold fast and mongery, all as specified, **32 mm thick.** | Sqm | 14086 |
| 7-34 | Same as item 7-33, but **38 mm thick.** | Sqm | 14161 |
| 7-35 | Supply and fix, **1st Class Hard Wood (Ash wood), Framed and Panelled doors,** gates etc., **panels filled with MDF 16 mm sheet,** including chowkats, hold fasts, and monger, all as specified, **32 mm thick.** | Sqm | 18895 |
| 7-36 | Same as item 7-35, but **38 mm thick.** | Sqm | 19483 |
| 7-37 | Supply and fix, **1st Class Hard Wood (Mahogany) Framed and Panelled Doors,** gates etc., **panels filled with MDF 16 mm sheet,** including chowkats, hold fasts and mongery, all as specified, **32 mm thick.** | Sqm | 18658 |
| 7-38 | Same as item 7-37, **but 38 mm thick.** | Sqm | 19233 |
| 7-39 | Deduct from item 7-33 and 7-34, if **chowkat 1st Class Soft wood (Deodar)** not supplied and fixed. | Sqm | 4675 |
| 7-40 | Deduct from item 7-35, 7-36, 7-37 and 7-38 if **chowkat 1st Class Hardwood (Ashwood/ Mahogany)** not supplied and fixed. | Sqm | 7099 |
| 7-41 | Supply and fix, **Solid Flush door, Teak veneered, 38 mm thick** including mongery, without chowkats. | Sqm | 13183 |
| 7-42 | Same as item 7-41, but **Sheesham veneered.** | Sqm | 13104 |
| 7-43 | Same as item 7-41, but **Commercial veneered.** | Sqm | 13072 |
| 7-44 | Supply and fix, **Solid Flush door, Teak veneered, 32 mm thick** including mongery, without chowkats. | Sqm | 11798 |
| 7-45 | Same as item 7-44, but **Sheesham veneered.** | Sqm | 11720 |
| 7-46 | Same as item 7-44, but **Commercial veneered.** | Sqm | 11687 |
| 7-47 | Supply and fix, **Solid Flush door, Teak veneered, 25 mm thick** including mongery, without chowkats. | Sqm | 10399 |
| 7-48 | Same as item 7-47, but **Sheesham veneered.** | Sqm | 10321 |
| 7-49 | Same as item 7-47, but **Commercial veneered.** | Sqm | 10288 |
| 7-50 | Same as item 7-47 to 7-49 but Fixing only. | Sqm | 492 |
| 7-51 | Add to item 7-47 to 7-50, if fixed in Repairs. | Sqm | 33 |
| 7-52 | Supply and fix, **Hollow Flush Door, Teak Veneered, 38 mm thick** including mongery, all as specified, without chowkats. | Sqm | 9380 |
| 7-53 | Same as item 7-52, but **Sheesham veneered.** | Sqm | 9329 |
| 7-54 | Same as item 7-52, but **Commercial veneered.** | Sqm | 9238 |
| 7-55 | Supply and fix, **Hollow Flush Door, Teak Veneered, 32 mm thick** including mongery, all as specified, without chowkats. | Sqm | 7863 |
| 7-56 | Same as item 7-55, but **Sheesham veneered.** | Sqm | 7785 |
| 7-57 | Same as item 7-55, but **Commercial veneered.** | Sqm | 7719 |
| 7-58 | Supply and fix, **Hollow Flush door, MDF (Medium Density Fibre board), 38 mm thick** with Malaysian ply 3mm thick with panels on both sides including internal, **1st Class Soft Wood (Deodar) frame,** 75mm x 32 mm, hydraulically hot pressed with glue, in any design, shape and pattern, complete, including ironmongery, except chowkat. | Sqm | 5392 |
| 7-59 | Supply and fix **Tubular Particle Board Engineered door, 38 mm thick** including mongery, all as specified, without chowkats. | Sqm | 9324 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 7-60 | Add to 7-41 to 7-49 and 7-52 to 7-59, if **chowkat 1st Class Soft Wood (Deodar)** supplied and fixed. | Sqm | 4675 |
| | **Aluminium Doors** | | |
| 7-61 | Supply **Aluminium Sliding Door, Deluxe Quality,** of Anodized Aluminium extruded section in any size, colour and texture, including fixing on concrete, wood or steel frames, complete except glass, lock and handle. | Sqm | 8768 |
| 7-62 | Same as item 7-61 but **Premium Quality,** all as specified. | Sqm | 9368 |
| 7-63 | Supply **Aluminium Swing door, Single shutter, Deluxe Quality** of Anodized Aluminium extruded section in any size, colour and texture as specified including fixing on concrete, wooden or steel frames, complete except glass, lock and handle. | Sqm | 8960 |
| 7-64 | Same as item 7-63 but **Premium Quality,** all as specified. | Sqm | 10112 |
| 7-65 | Supply **Aluminium Swing door, Double shutter, Deluxe Quality** of Anodized Aluminium extruded section in any size, colour and texture as specified including fixing on concrete, wooden or steel frames, complete except glass, lock and handle. | Sqm | 9428 |
| 7-66 | Same as item 7-65 but **Premium Quality,** all as specified. | Sqm | 10328 |
| 7-67 | Fixing only, **Aluminium door any type** on concrete, wooden or steel frames, complete, except glass, lock and handle. | Sqm | 495 |
| | **uPVC Doors** | | |
| 7-68 | Supply and fix, **uPVC Sliding Door,** 37 mm thick shutter with frame 80mm x 50mm exceeding 3.5 sqm each in white colour including all necessary fittings, mongery, fly proof netting except glass, complete all as specified. | Sqm | 10372 |
| 7-69 | Same as item 7-68, but coloured. | Sqm | 18377 |
| 7-70 | Supply and fix, **uPVC Door,** 60 mm thick shutter for full glass with frame complete exceeding 1.9 sqm each, in white colour including necessary fittings, mongery except glass, complete all as specified. | Sqm | 15286 |
| 7-71 | Same as item 7-70, but coloured. | Sqm | 16935 |
| 7-72 | Same as item 7-70, but with groove panel 20 mm thick, filled instead of glass, as specified complete in white colour. | Sqm | 21164 |
| 7-73 | Same as item 7-72, but coloured. | Sqm | 23760 |
| | **Chowkats** | | |
| 7-74 | Supply and fix **1st class soft wood (Deodar) Dolly frame chowkat** using 57 mm x 57 mm fillets on edge sides of wall and @ 381 mm c/c cross fillets, covered with **3mm commercial ply,** including architrave on both sides (inside/ outside), not exceeding 12.90 sqcm in any design/shape, hold fasts, bitumen coating on wall side of frame and wood preservative on remaining sides of frame, gaps filled with **PCC 1:2:4** for **230mm wall,** complete, all as specified. (Single/Double rebate). | Sqm | 6549 |
| 7-75 | Same as item 7-74 but **sheesham ply.** | Sqm | 6563 |
| 7-76 | Same as item 7-74 but **teak ply.** | Sqm | 6581 |
| 7-77 | Same as item 7-74 but for **345 mm wall,** complete, all as specified. | Sqm | 7277 |
| 7-78 | Same as item 7-77 but **sheesham ply.** | Sqm | 7294 |
| 7-79 | Same as item 7-77 but **teak ply.** | Sqm | 7333 |
| 7-80 | Supply and fix, **Steel Chowkat press-moulded 16 SWG, for 115 mm walls, single leaf,** complete, including hold fast, ties for lateral movement, PCC 1:2:4 cavity filling etc, including one coat of anti-Creosote paint (internal surface) and Red oxide paint (external surface). , t | Metre | 949 |
| 7-81 | Same as item 7-80, but **230 mm wall, (Single/Double Leaf).** | Metre | 1280 |
| 7-82 | Same as item 7-80, but **342 mm wall, (Single/Double Leaf).** | Metre | 1729 |
| 7-83 | Same as item 7-80, but **18 SWG.** | Metre | 801 |
| 7-84 | Same as item 7-81, but **18 SWG:** | Metre | 1095 |
| 7-85 | Same as item 7-80, but **18 SWG.** | Metre | 1472 |

| SINO | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Windows / Sashes/CSWs** | | |
| 7-86 | Supply and fix, **1st Class Soft wood (Deodar),** wrought, sashes, glazed with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and fixed with screws to frames, **32 mm thick.** | Sqm | 12024 |
| 7-87 | Same as item 7-86, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 11981 |
| 7-88 | Same as item 7-86, but **38 mm thick, glazed.** | Sqm | 12412 |
| 7-89 | Same as item 7- 88, but wire gauzed, 9x9 mesh, 24 gauge. | Sqm | 12391 |
| 7-90 | Deduct from item 7-86 to 7-89, if chowkats not supplied and fixed. | | 7250 |
| 7-91 | Supply and fix, **1st Class Hard wood (Sheesham),** wrought, sashes, glazed with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and fixed with screws to frames, **32 mm thick.** | Sqm | 10716 |
| 7-92 | Same as item 7-91, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 10981 |
| 7-93 | Same as item 7-91, but **38 mm thick, glazed.** | Sqm | 10716 |
| 7-94 | Same as item 7-93, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 10693 |
| 7-95 | Deduct from item 7-91 to 7-94, if chowkats not supplied and fixed. | Sqm | 5410 |
| 7-96 | Supply and fix, **1st class Soft wood (Deodar), CSWs** glazed, with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and hung with pivots and mongery all as specified, **32 mm thick.** | Sqm | 15605 |
| 7-97 | Same as item 7-96, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 15588 |
| 7-98 | Same as item 7-96, but **38 mm thick.** | Sqm | 15875 |
| 7-99 | Same as item 7-98, but gauzed, 9x9 mesh, 24 gauge. | -sqm | 15926 |
| 7-100 | Deduct from item 7-96 to 7-99, if chowkats not supplied and fixed. | Sqm | 10924 |
| 7-101 | Supply and fix, **1st class Hard wood (Sheesham), CSWs** glazed with moulded or chamfered bars, panels filled in with glass including chowkats, holdfasts and hung with pivots and mongery all as specified, **32 mm thick.** | Sqm | 11217 |
| 7-102 | Same as item 7-101, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 11200 |
| 7-103 | Same as item 7-101, but **38 mm thick.** | Sqm | 11486 |
| 7-104 | Same as item 7-103, but gauzed, 9x9 mesh, 24 gauge. | Sqm | 11395 |
| 7-105 | Deduct from item 7-101 to 7-104, if chowkats not supplied and fixed. | Sqm | 7048 |
| 7-106 | Deduct from item 7-97, 7-99, 7-102 and 7-104, if **mosquito proof gauze** is used. | Sqm | 409 |
| 7-107 | Supply and fix, **Venetian shutter** for windows made of **1st class Soft wood (Deodar),** 100 mm wide rail and styles and **Hard wood (Sheesham)** Venetian, including chowkats 75 mm x 125 mm, holdfasts and fixed with screws to frame, **32 mm thick.** | Sqm | 13512 |
| 7-108 | Same as item 7-107, but **38 mm thick.** | Sqm | 14301 |
| 7-109 | Deduct from item 7-107 and 7-108, if chowkats **1st class Soft wood (Deodar)** not supplied and fixed. | Sqm | 6325 |
| | **Aluminium Windows** | | |
| 7-110 | Supply of **Aluminium Sliding window, Deluxe Quality,** of Anodized Aluminium extruded section in any size, colour and texture as specified, including fixing on concrete, wood or steel frames, complete with all necessary fittings except glass. | Sqm | 8567 |
| 7-111 | Same as item 7-110 but **Premium Quality.** | Sqm | 8927 |
| 7-112 | Supply of **Aluminium Fixed window, Deluxe Quality,** of Anodized Aluminium extruded section in any size, colour and texture as specified, including fixing on concrete, wood or steel frames, complete with all necessary fittings except glass. | Sqm | 6527 |
| 7-113 | Same as item 7-112 but **Premium Quality.** | Sqm | 6895 |
| 7-114 | Supply of **Aluminium Side Hung window, Deluxe Quality,** of Anodized Aluminium extruded section in any size, colour and texture as specified, including fixing on concrete, wood or steel frames, complete with all necessary fittings except glass. | Sqm | 7727 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 7-115 | Same as item 7-114 but **Premium Quality.** | Sqm | 8095 |
| | **Steel Windows** | | |
| 7-116 | Supply and fix, **Box type steel sliding/fixed window or CSW** using 16 gauge frame section 75 mm x 30 mm and panel section 25 mm x 50 mm and 10 mm x 10 mm square gola, with all necessary steel fitting / mongery hold fast etc. and two coats of SE paint in addition to one coat of primer/ rust proof paint, except glass panes, grill and wire gauze. | Sqm | 6759 |
| 7-117 | Supply and fix, **Box Pipe type open-able and fixed side-hung window or CSW** using 16 gauge frame section 50mm x 25mm and panel Z shape 38 mm x 31 mm x 38 mm and 10mm x 10mm square gola, not exceeding 1.48 Sqm each, with all necessary fittings/mongery, hold fast etc. and two coats of SE paint in addition to one coat of primer / rust proof paint, except wire gauze and glass panes and grill. | Sqm | 7289 |
| 7-118 | Same as item 7-117 but exceeding 1.48 Sqm, all as specified. | Sqm | 7287 |
| | **uPVC Windows** | | |
| 7-119 | Supply and fix **uPVC sliding window** in white colour 37 mm thick shutter with , frame 80 mm x 50 mm complete exceeding 2.23 Sqm each in white colour including necessary fittings, mongery, fly proof netting, except glass. | Sqm | 10843 |
| 7-120 | Same as item 7-119, but coloured. | Sqm | 19894 |
| 7-121 | Supply and fix, **uPVC open able window,** 60 mm thick shutter with frame complete, exceeding 2.23 sqm each in white colour including necessary fittings, mongery, except glass. | Sqm | 11986 |
| 7-122 | Same as item 7-121, but coloured. | Sqm | 19127 |
| 7-123 | Supply and fix, **uPVC 37mm thick fixed window,** with frame complete exceeding 2.23 sqm each, in white colour including necessary fittings, mongery except glass. | Sqm | 7578 |
| 7-124 | Same as item 7-123, but coloured. | Sqm | 12010 |
| | **Partitions** | | |
| 7-125 | Supply and fix, **1st Class Soft Wood (deodar) framed and panelled partitions and dados, 32 mm thick.** | Sqm | 6732 |
| 7-126 | Same as item 7-125, but **38 mm thick.** | Sqm | 7101 |
| 7-127 | Supply and fix, **1st Class Hard Wood (Sheesham) Framed and Panelled partitions and dados, 32 mm thick.** | Sqm | 6017 |
| 7-128 | Same as item 7-127, but **38 mm thick.** | Sqm | 6340 |
| 7-129 | Supply and fix, **1st Class Hard wood {Ash Wood) framed and panelled partitions and dados 32 mm thick** all as specified. | Sqm | 10621 |
| 7-130 | Same as item 7-129 but **38 mm thick** all as specified. | Sqm | 11357 |
| 7-131 | Supply and **fix,1st Class Hard wood (Mohagany), framed and panelled partition and dados 32 mm thick,** all as specified. | Sqm | 10466 |
| 7-132 | Same as item 7-131 but **38 mm thick** all as specified. | Sqm | 11189 |
| 7-133 | Supply and **fix,12mm thick Plate Glass partition/door** in any size including all necessary accessories i.e. pivot machine, handle lock etc. | Sqm | 10316 |
| | **Kitchen Cabinets** | | |
| 7-134 | Supply and fix, **Kitchen Floor** / **Sink Floor Cabinet,** 600 mm wide and 862 mm high with **First Class Soft wood (Deodar)** frame, 19 mm thick **Teak Veneered board shutter,** drawers including all necessary Chromium plated (CP) mongery, RCC slab, 25 mm thick white/ coloured marble slab, a;omplete as per IS Arch 17,18 and 19. | Metre | 14209 |
| 7-135 | Supply and fix, **Kitchen Wall Cabinet** 381mm wide and 610 mm high, 19 mm thick **Teak Veneered board shutter** complete as per IS Arch 17, 18 and 19, including all necessary CP monger, fixture and deodar wood edging provided to door cabinets. | Metre | 7596 |

| Sl No | Description | Unit | Rate {Rs} |
|---|---|---|---|
| 7-136 | Supply and fix, **Kitchen Exhaust Hood** made of **Teak Veneered board** with 22BG, PGI sheet fixed on inner side complete as per Information Sheet IS Arch No 17, 18 and 19, including all fitting / fixture as specified. | Metre | 6721 |
| | **Venetian Blinds** | | |
| 7-137 | Supply and fix, **Venetian blinds (Horizontal)** having metallic, plastic strip, upto 25mm width, complete with all accessories. | Sqm | 2193 |
| 7-138 | Supply and fix, **Venetian blind (Vertical)** having fabric strip, upto 90 mm width, of desired shades, complete with all accessories. | Sqm | 3691 |
| 7-139 | Same as item 7-138, but strip width exceeding 90mm upto 127 mm. | Sqm | 4078 |
| 7-140 | Supply any fix, Venetian blinds (horizontal) having wooden strip, complete with all accessories. | Sqm | 4338 |
| | **Wire Gauze** | | |
| 7-141 | Supply Iron tinned **wire gauze fly proof 9x9 mesh, 24 gauge** and fixed with cover fillets to window chowkats etc. | Sqm | 1435 |
| 7-142 | Same as item 7-141, but **22 gauge.** | Sqm | 1543 |
| 7-143 | Same as item 7-141 or 7-142, but except cost of wire gauze. | Sqm | 608 |
| 7-144 | Add to item 7-141 to 7-143, if fixed in repairs. | Sqm | 111 |
| 7-145 | Supply of **Iron tinned wire gauze mosquito proof 18 x 18 mesh, 28 gauge** and fixed with cover fillets to window chowkats etc. | Sqm | 822 |
| 7-146 | Same as item 7-145, but except cost of wire gauze. | Sqm | 527 |
| 7-147 | Add to item 7-145 or 7-146, if fixed in repairs. | Sqm | 111 |
| 7-148 | Supply **Iron tinned wired gauze fly proof 9 x 9 mesh, 22 gauge** and fixed with flat iron 13 mm x 3 mm to steel window frames with screws 75 mm c/c, complete. | Sqm | 1468 |
| 7-149 | Same as item 7-148, but **24 gauge.** | Sqm | 1359 |
| 7-150 | Same as item 7-148 or 7-149, but except cost of wire gauze. | Sqm | 528 |
| 7-151 | Add to item 7-148 or 7-149 or 7-150, if fixed in repairs. | Sqm | 71 |
| 7-152 | Supply of **Iron tinned wire gauze, 18 x 18 mesh, 26 gauge** and fixed with flat iron 13 mm x 3 mm to steel window frames with screws 75 mm c/c complete. | Sqm | 744 |
| 7-153 | Same as item 7-152, but except cost of wire gauze. | Sqm | 528 |
| 7-154 | Add to item 7-152 or7-153, if fixed in repairs. | Sqm | 71 |
| 7-155 | Supply of **Aluminium wire gauze 16x16 mesh, 26 gauge** and fixed with flat iron 13 mm x 3 mm to steel window frames with screws 75 mm c/c, complete. | Sqm | 1141 |
| 7-156 | Same as item 7-155, but except cost of wire gauze. | Sqm | 528 |
| 7-157 | Add to item 7-155 or 7-156, if fixed in repairs. | Sqm | 71 |
| 7-158 | Supply of **Aluminium fly/ insects screening with mesh (Deluxe and premium model),** of Anodized exbuded section induding fixing on concrete, wood or steel frames with all necessary fittings, complete all as specified. | Sqm | 4555 |
| 7-159 | Same as item 7-158 but fixing only. | Sqm | 33 |
| | **Jobbing works** | | |
| 7-160 | Re-securing without taking down window chowkats including window boards, if any, (Hard/Soft wood). | Each | **248** |
| 7-161 | Taking down window chowkats including window boards, if any, (Hard/Soft wood) and refixing in same opening. | Each | 436 |
| 7-162 | Same as item 7-161, but refixing in other opening. | Each | 523 |
| 7-163 | Taking down window chowkats including window boards, if any, (Hard/Soft wood). | Each | 105 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 7-164 | Removing to or from store window chowkats including window boards, if any, (Hard/Soft wood). | Each | 69 |
| 7-165 | Re-securing without taking down window chowkats including Sashes (Hard/Soft wood). | Each | 175 |
| 7-166 | Taking down window chowkats including sashes (Hard/Soft wood) and re-fixing in same opening. | Each | 415 |
| 7-167 | Same as item 7-166, but re-fixing in other opening. | Each | 601 |
| 7-168 | Taking down window chowkats, including sashes (Hard/Soft wood). | Each | 62 |
| 7-169 | Removing to or from store, window chowkats including sashes (Hard/Soft wood). | Each | 40 |
| 7-170 | Re-securing without taking down casement window fanlights etc. (sashes only) (Hard/Soft wood). | Each | 122 |
| 7-171 | Taking down casement, window, fanlights etc. (sashes only) (Hard/Soft wood) and re-fixing same opening. | Each | 229 |
| 7-172 | Same as item 7-171, but re-fixing in other openings. | Each | 275 |
| 7-173 | Taking down casement, windows, fanlights etc. (sashes only), Hard /Soft wood. | Each | 53 |
| 7-174 | Removing to or from store, casement, window, fanlights etc. (sashes only) Hard/ Soft wood. | Each | 20 |
| 7-175 | Re-securing without taking down door chowkats (not exceeding 2.60 m each) including architraves if any, (Hard/Soft wood). | Each | 249 |
| 7-176 | Taking down door chowkats (not exceeding 2.60 m each) including architraves if any, Hard/Soft wood and refixing in same opening. | Each | 415 |
| 7-177 | Same as item 7-176, but re-fixing in other opening. | Each | 506 |
| 7-178 | Taking down door chowkats (not exceeding 2.60 m each) includingarchitraves, if any, Hard/Soft wood. | Each | 125 |
| 7-179 | Removing to or from store door chowkats (not exceeding 2.60 m super each) incl architraves, if any, Hard/Soft wood. | Each | 50 |
| 7-180 | Re-securing without taking down door chowkats (exceeding 2.60m each) including architraves if any, Hard/Soft wood. | Each | 436 |
| 7-181 | Taking down door chowkats (exceeding 2.60m each) including architraves if any, Hard/ Soft wood and re-fixing in same opening. | Each | 601 |
| 7-182 | Same as item 7-181, but re-fixing in other opening. | Each | 634 |
| 7-183 | Taking down door chowkats (exceeding 2.60 m each) including architraves if any, Hard /Soft wood. | Each | 270 |
| 7-184 | Removing to or from store, door chowkats (exceeding 2.60 m each) including architraves if any, Hard /Soft wood. | Each | 83 |
| 7-185 | Re-securing without taking down door or gates, leaves only (single or folding) of any pattern or thickness not exceeding 2.60 m each, Hard /Soft wood. | Each | 56 |
| 7-186 | Taking down door or gates, leaves only (single or folding) of any pattern or thickness.not.exceeding 2.60 m each, Hard/ Soft wood and re-fixing in same opening. | Each | 146 |
| 7-187 | Same as item 7-186, but re-fixing in the other opening. | Each | 201 |
| 7-188 | Taking down door or gates, leaves only (single or folding) of any pattern or thickness not exceeding 2.60 m each. | Each | 55 |
| 7-189 | Removing to or from store door or gates, leaves only (single or folding) of any pattern or thickness exceeding 2.60 m each. Hard/ Soft wood. | Each | 30 |
| 7-190 | Re-securing without taking down partitions, framing, cupboard front, wall panelling and similar woodwork, including doors exceeding 2.60 m each, Hard / Soft wood. | Sqm | 125 |
| 7-191 | Taking down partitions, framing, cupboard front, wall panelling and similar woodwork, including doors exceeding 2.60 m each Hard / Soft wood and re-fixing in same opening. | Sqm | 435 |
| 7-192 | Same as item 7-191, but re-fixing in other opening. | Sqm | 1058 |

DOORS AND WINDOWS

| SI NO | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 7- 193 | taking down partitions, framing, cupboard front, wall paneling and similar Woodwork, including doors exceeding 2.60 m each, hard/ soft wood. | Sqm | 259 |
| 7 -194 | Removing to or from store,, partitions, framing, cupboard front, wall paneling And similar woodwork, including doors exceeding doors exceeding 2.60m Each , Hard / Soft wood. | Sqm | 240 |
| 7-195 | Door of gates (any description) cramped up, reweighed with new wedges In glue (or white lead repined if in external work) not exceeding 2.60 m Each , including taking down and re-hanging taking off and re-fixing hinges (any description) and removing to and from workshop. | each | 666 |
| 7-196 | Same as item 7-195,but exceeding 2.6 m each. | Each | 691 |
| 7.197 | Door or gates (any description) cramped up, reweighed with new wedges In glue (or white lead repined if in external work ) not exceeding 2.60 m Each including taking down and re-hanging taking off and re-fixing hinges (any description) and renewal of defective parts and removing to and from Workshop. | Each | 728 |
| 7-198 | Same as item 7-197 , but exceeding 2.60 m each. | Each | 1047 |

# SECTION-8

# ANCILLARY ITEMS

# (MONGERY)

# RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION – 8

# ANCILLARY ITEMS (MONGERY)

## SPECIFICATIONS

**8.0.** This Section covers Iron/Steel, Chromium plated (CP) and Brass mongery.

## MATERIAL REQUIREMENTS

**8.1. Mongery.** All articles of mongery shall be sound, strong and well finished, according to the specified weight.

**8.2.** The weight of articles of mongery (covering any type of finish) shall be within 10% or the weight given in Table 8-1 to 8-6:-

**8.3.** Engineer-in-Charge will approve sample of mongery for each contract before incorporation. Weight for size other than those given in the Table 8-1 to 8-6 shall be prorata to the size.

**TABLE 8-1**

**WEIGHT OF TEN NUMBERS ARTICLES - (KG)**

**(Including Weight of Necessary Screws etc)**

| Articles | 100 mm | | 150 mm | |
|---|---|---|---|---|
| | Steel | Brass | Steel | Brass |
| Hooks and Eyes, cabin or casement | 0.59 | 0.63 | 0.73 | 0.77 |
| Hooks and screw pattern (wire) | 0.33 | 0.35 | 0.69 | 0.73 |
| Knobs cupboard 30 mm | - | - | - | 0.14 |
| Hasp and Staple 100 mm | - | - | 0.45 | - |

**TABLE 8-2**

| Articles | SIZE (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | | 150 | | 200 | | 300 | | 450 | |
| | Steel | Brass | Steel | Brass | Steel | Brass | Steel | Brass | Steel | Brass |
| Tower Bolts plate thickness (20 gauge) | 1.84 | 1.17 | 2.24 | 1.42 | 2.48 | 2.14 | 2.95 | 3.97 | ... | ... |
| All drop plate thickness (16 to 18 gauge) | ... | ... | ... | ... | 4.23 | 7.69 | 9.66 | 11.58 | 13.44 | 16.54 |

**TABLE 8-3**

| Articles | SIZE (mm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 50 | | 75 | | 100 | | 125 | |
| | Steel | Brass | Steel | Brass | Steel | Brass | Steel | Brass |
| Hinges Butt | 0.34 | 0.39 | 0.70 | 0.85 | 1.42 | 1.42 | 2.13 | 2.27 |
| Hinges Parliament | - | - | 2.50 | ... | 4.26 | ... | 5.67 | ... |

**TABLE 8-4**

| Articles | SIZE (mm) | | |
|---|---|---|---|
| | 250 | 300 | 450 |
| Hinges straps, cross garnet etc., Steel | 3.00 | 4.08 | 8.35 |
| Hinges ,hook and ride, Steel | ... | 12.02 | 17.69 |

**TABLE 8-5**

| Articles | Steel | Brass |
|---|---|---|
| Thumb latches, 195 mm x 44 mm | 2.54 | ... |
| Thumb latches, 244 mm x 56 mm | 3.40 | ... |
| Cleats belaying, 100 mm | 0.46 | 0.47 |
| Catches, 50 mm | 0.97 | 0.93 |
| Catches, 63 mm | 1.23 | 1.17 |
| Fasteners Cockspur | 2.00 | 2.13 |
| Fasteners and Stays (casement) 300 mm | 2.80 | 3.22 |
| Fasteners and (casement) 380 mm | 3.54 | 4.00 |
| Pivot and sockets, 56 mm (per TEN sets) | 0.79 | 0.82 |
| Stays quadrant, for fanlights, 300 mm | 2.72 | 2.90 |
| Handles, Bow 150 mm | 0.64 | 1.11 |
| Handles, drawer pull 100 mm | 0.39 | 0.71 |
| Hooks, hat and coat, 175 mm single | 1.38 | 1.54 |
| Hooks, Wardrobe, 56 mm single | 0.46 | 0.54 |

**TABLE 8-6**

| Articles | SIZE IN MILLIMETRES | |
|---|---|---|
| | 25mm | 38mm |
| Hooks screw (dresser or cup) Steel | 0.08 | 0.10 |
| Hooks screw (dresser or cup) Brass | 0.09 | 0.12 |

## METHOD OF MEASUREMENTS

**8.4. General.** The under mentioned articles of mongery shall be measured as indicated in the Table 8-7:-

**TABLE 8-7**

| Articles | How Measured |
|---|---|
| Bolts | The length of plates in Flush and French, Casement bolts.<br>The length of shoots in the case of level, tower or all other drop bolts. |
| Hasps & staples | The overall length of the Hasp. |
| Hinges | The length of the joint of Butt and Back flap Hinges.<br>Overall of Parliament hinges when open.<br>The length of straps, cross garnet, hook and ride hinges from the joint or knuckle to the point. |
| Latches | The overall length of the plate for mounted latches or the handle for un-mounted latches. |
| Locks | The length or width (whichever is greater). |
| Curtain rod | Curtain Rod Stainless steel / chrome plated pipe 25 mm dia, with Brass or steel brackets as per length of window and 150 mm extension on each side. |

## CLARIFICATION OF RATES

**8.5.** The rates, inter alia, include particularly:-

(1) Fixing to softwood or hardwood.

(2) Brass articles are to be fixed with brass screws. Screws be round or flat headed, as required.

(3) Keys to differ, if required two to three keys to each lock and stamping as required.

(4) Plugs and plugging to walls, building into walls or floors and making good.

(5) Burnishing and lacquering of exposed surfaces of Brass fittings.

(7) Easing, oiling and leaving all mongery in good condition.

**8.6.** If Brass mongery is ordered to be finished "Copper Bronze", 33% will be added to the "except fixing" rates.

**8.7.** **"Fixing only"** rates including the supply of screws.

**8.8.** The rates for **"Fixed in repairs"** include taking off the old articles and removing to store, also for plugging up old key holes, spindle holes, screw holes etc., where necessary.

**8.9.** The rates for **"Taking off and Re-Fixing"** also include adjustment, plugging up key holes etc., as required.

## ITEM RATES

| Sl No | Description | Unit | Rate(Rs) |
|---|---|---|---|
| | **Tower Bolts** | | |
| 8-1 | Supply and fix, **100 mm long, CP tower bolts** with bright shoots, and fixed with sockets or let into any material. | Each | 146 |
| 8-2 | Same as item 8-1, but fixing only. | Each | 98 |
| 8-3 | Same as item 8-1 to 8-2, if fixed in repairs. | Each | 42 |
| 8-4 | Supply and fix, **100 mm long, Brass tower bolts** with Brass shoots, and fixed with sockets or let into any material. | Each | 274 |
| 8-5 | Same as item 8-4, but fixing only. | Each | 93 |
| 8-6 | Same as item 8-4 or 8-5, if fixed in repairs. | Each | 42 |
| 8-7 | Supply and fix **150 mm long, CP tower bolts** with bright shoots, and fixed w"ith sockets or let into any material. | Each | 196 |
| 8-8 | Same as item 8-7, but fixing only. | Each | 124 |
| 8-9 | Same as 8-7 or 8-8, if fixed in repairs. | Each | 53 |
| 8-10 | Supply and fix, **150 mm long, Brass tower bolts** with Brass shoots, and fixed with sockets or let into any material. | Each | 322 |
| 8-11 | Same as item 8-10, but fixing only. | Each | 117 |
| 8-12 | Add to item 8-10 or 8-11, if fixed in repairs. | Each | 53 |
| 8-13 | Supply and fix, **200 mm long, CP tower bolts** with bright shoots, and fixed with sockets or let into any material. | Each | 242 |
| 8-14 | Same as item 8-13, but fixing only. | Each | 145 |
| 8-15 | Add to item 8-13 or 8-14, if fixed in repairs. | Each | 63 |
| 8-16 | Supply and fix, **200 mm long, Brass tower bolts** with Brass shoots, and fixed with sockets or let into any material. | Each | 476 |
| 8-17 | Same as item 8-16, but fixing only. | Each | 138 |
| 8-18 | Same as item 8-16 or 8-17, if fixed in repairs. | Each | 63 |
| | **Bolts (All Drops)** | | |
| 8-19 | Supply and fix, **300 mm long CP, sliding and locking bolts with staple** (Plate thickness 16- 18 **gauge).** | Each | 512 |
| 8-20 | Same as item 8-19, but fixing only. | Each | 182 |
| 8-21 | Add to item 8-19 or 8-20, if fixed in repairs. | Each | 126 |
| 8-22 | Supply and fix, **300 mm long, Brass sliding and locking bolts with staple** (Plate thickness 16 -18 gauge). | Each | 1619 |
| 8-23 | Same as item 8-22, but fixing only. | Each | 171 |
| 8-24 | Same as item 8-22 or 8-23, if fixed in repairs. | Each | 63 |
| 8-25 | Supply and fixing, **450 mm long, CP, sliding and locking bolts with staple** (Plate thickness 16 - 18 gauge). | Each | 848 |
| 8-26 | Same as item 8-25, but fixing only. | Each | 226 |
| 8-27 | Add to item 8-25 or 8-26, if fixed in repairs. | Each | 63 |
| 8-28 | Supply and fix, **450 mm long, Brass sliding and locking bolts with staple** (plate thickness 16 -18 gauge). | Each | 2055 |
| 8-29 | Same as item 8-28, but fixing only. | Each | 210 |
| 8-30 | Add to item 8-28 or 8-29, if fixed in repairs. | Each | 63 |
| | **Hinges** | | |
| 8-31 | Supply and fix, **hinges, Butt, Steel, 50mm long.** | Each | 152 |
| 8-32 | Same as item 8-31, but **75 mm long.** | Each | 224 |
| 8-33 | Same as item 8-31, but **100 mm long.** | Each | 298 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 8-34 | Same as item 8-31, but **125 mm long.** | Each | 400 |
| 8-35 | Same as item 8-31 to 8-34, if fixing only. | Each | 67 |
| 8-36 | Add to item 8-31 to 8-35, if fixed in repairs. | Each | 48 |
| 8-37 | Supply and fix, **hinges, Butt, Brass, 50 mm long.** | Each | 194 |
| 8-38 | Same as item 8-37, but **75 mm long.** | Each | 346 |
| 8-39 | Same as item 8-37, but **100 mm long.** | Each | 418 |
| 8-40 | Same as item 8-37, but **125 mm long.** | Each | 640 |
| 8-41 | Same as item 8-37 to 8-40, but fixing only. | Each | 60 |
| 8-42 | Add to item 8-37 to 8-41, if fixed in repairs. | Each | 48 |
| 8-43 | Supply and fix, hinges, **Parliament, Steel, 75mm long.** | Each | 563 |
| 8-44 | Same as item 8-43, but **100 mm long.** | Each | 606 |
| 8-45 | Same as item 8-43, but **125 mm long.** | Each | 171 |
| 8-46 | Same as item 8-43 to 8-45, but fixing only. | Each | 51 |
| 8-47 | Add to item 8-43 to 8-46, if fixed in repairs. | Each | 42 |
| 8-48 | Supply and fix, **CP hinges, 16 mm wide and 1800 mm long (Piano Type).** | Each | 305 |
| 8-49 | Same as item 8-48, but **19 mm wide and 1800 mm long (Piano Type).** | Each | 249 |
| 8-50 | Same as item 8-48, but **25 mm wide and 1800 mm long (Piano Type).** | Each | 516 |
| 8-51 | Same as item 8-48 or 8-49 or 8-50, but fixing only. | Each | 184 |
| 8-52 | Add to item 8-48 to 8-51, if fixing in repairs. | Each | 42 |
| 8-53 | Supply and fix **CP hinges, 25 mm wide and 2025 mm long (Piano Type).** | Each | 538 |
| 8-54 | Same as item 8-53, but fixing only. | Each | 207 |
| 8-55 | Add to item 8-53 or 8-54, if fixed in repairs. | Each | 42 |
| 8-56 | Supply and fix, **Brass hinges, 13 mm wide and 1800 mm long (Piano type).** | Each | 630 |
| 8-57 | Same as item 8-56, but **16 mm wide and 1800 mm long (Piano type).** | Each | 684 |
| 8-58 | Same as item 8-56, but **19 mm wide and 1800 mm long (Piano type).** | Each | 721 |
| 8-59 | Same as item 8-56, but **25 mm wide and 1800 mm long (Piano type).** | Each | 901 |
| 8-60 | Same as item 8-56 to 8-60, but fixing only. | Each | 128 |
| 8-61 | Add to item 8-56 to 8-60, but fixed in repairs. | Each | 42 |
| 8-62 | Supply and fix, **Brass hinges 25 mm wide and 2025 mm long (Piano type).** | Each | 1045 |
| 8-63 | Same as item 8-62, but fixing only. | Each | 164 |
| 8-64 | Add to item 8-62 or 8-63, if fixed in repairs. | Each | 63 |
| | **Spring Hinges** | | |
| 8-65 | Supply and fix, **100mm long, Double action, Brass spring hinges.** | Per set | 1189 |
| 8-66 | Same as item 8-65, but **115 mm long.** | Per set | 1654 |
| 8-67 | Same as item 8-65, but **125 mm long.** | Per set | 1849 |
| 8-68 | Same as item 8-65, but **150 mm long.** | Per set | 2036 |
| 8-69 | Same as item 8-65 to 8-68, but fixing only. | Per set | 117 |
| 8-70 | Same as item 8-65 to 8-69, if fixed in repair. | Per set | 105 |
| 8-71 | Supply and fix, **100mm Brass spring hinges.** | Each | 527 |
| 8-72 | Same as item 8-71, but **115 mm long.** | Each | 659 |
| 8-73 | Same as item 8-71, but **125 mm long.** | Each | 741 |
| 8-74 | Same as item 8-71 to 8-73, but fixing only. | Each | 136 |
| 8-75 | Add to item 8-71 to 8-74, if fixed in repairs. | Each | 122 |
| 8-76 | Supply and fix, **Hydraulic door closer, Standard.** | Each | 937 |
| 8-77 | Same as item 8-76, but **Deluxe.** | Each | 2472 |
| 8-78 | Same as item 8-76, but fixing only. | Each | 231 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 8-79 | Add to item 8-76 to 8-78, if fixed in repairs. | Each | 147 |
| | **Latches** | | |
| 8-80 | Supply and fix, **Japanned Pressed Steel latch**, 100 mm long strong brass bolt and knob with 2 brass levers. | Each | 873 |
| 8-81 | Same as item 8-80, but fixing only. | Each | 194 |
| 8-82 | Add to item 8-80 or 8-81, if fixed in repairs. | Each | 42 |
| | **Locks** | | |
| 8-83 | Supply and fix, **CP lock or latch, 150 mm** with two bolts and two levers, in any pattern/shape. | Each | 798 |
| 8-84 | Supply and fix **Rim / Alpha lock Standard Quality,** all as specified. | Each | 1152 |
| 8-85 | Same as item 8-84 but **Deluxe Quality**, all as specified. | Each | 1629 |
| 8-86 | Same as item 8-84 but **Premium Quality,** all as specified. | Each | 2600 |
| 8-87 | Same as item 8-83 to 8-86, but fixing only. | Each | 195 |
| 8-88 | Add to item 8-83 to 8-87, if fixed in repairs. | Each | 42 |
| | **Locks (Cupboards)** | | |
| 8-89 | Supply and fix, **CP locks for cupboard 50 mm**, complete. | Each | 154 |
| 8-90 | Supply and fix, **Brass locks for cupboard 50 mm**, complete. | Each | 266 |
| 8-91 | Same as item 8-89 to 8-90, but fixing only. | Each | 48 |
| 8-92 | Same as item 8-89 to 8-91, if fixed in repair. | Each | 42 |
| | **Catches Spring** | | |
| 8-93 | Supply and fix, **catch spring, Deluxe** 50 / 63 mm with projecting ring, and staples or skirting plate (fan light, hung at bottom opening inwards or hung at top opening outwards). | Each | 137 |
| 8-94 | Same as item 8-93, but **Premium**. | Each | 271 |
| 8-95 | Same as item 8-93 or 8-94, but fixing only. | Each | 35 |
| 8-96 | Add to item 8-93 to 8-95, if fixing in repairs. | Each | 11 |
| | **Fastener, Cockspur** | | |
| 8-97 | Supply and fix, **Steel** fastener, cockspur medium size, with slot (or staples) for casements. | Each | 117 |
| 8-98 | Same as item 8-97, but **Brass.** | Each | 126 |
| 8-99 | Same as item 8-97 or 8-98, but fixing only. | Each | 35 |
| 8-100 | Same as item 8-97 or 8-99, if fixed in repairs. | Each | 21 |
| 8-101 | Supply and fix, **Steel** fastener and stays (casement) 300mm with hinged joint and two plates with studs complete. | Each | 247 |
| 8-102 | Same as item 8-101, but **Brass** | Each | 313 |
| 8-103 | Same as item 8-101 or 8-102, but fixing only. | Each | 135 |
| 8-104 | Add to item 8-101 to 8-103, if fixed in repairs. | Each | 63 |
| 8-105 | Supply and fix, **Steel** fastener and stays (casement) 380mm with hinged joint and two plates with studs complete. | Each | 293 |
| 8-106 | Same as item 8-105, but **Brass.** | Each | 253 |
| 8-107 | Same as item 8-105 or 8-106, but fixing only. | Each | 132 |
| 8-108 | Same as item 8-105 to 8-107, if fixed in repairs. | Each | 63 |
| 8-109 | Supply and fix, **Steel** studs on plate (when ordered separately). | Each | 35 |
| 8-110 | Same as item 8-109, but **Brass.** | Each | 124 |
| 8-111 | Same as item 8-109 or 8-110, but fixing only. | Each | 31 |
| 8-112 | Add to item 8-109 or 8-111, if fixed in repairs. | Each | 13 |

| Sl No | Description | Unit | Rate(Rs) |
|---|---|---|---|
| | **Cleat Hinges** | | |
| 8-113 | Supply and fix, Cleats, wooden not exceeding 442 cucm, wrought and splayed to doors and windows, including 75mm pressed **steel** butt hinges and fixing with screws. | Each | 147 |
| 8-114 | Same as item 8-113, but fixing only. | Each | 56 |
| 8-115 | Same as item 8-113 or 8-114, if fixed in repairs. | Each | 21 |
| 8-116 | Supply and fix, steel handle bow, 150mm overall. | Each | 200 |
| 8-117 | Same as item 8-116, but **Brass.** | Each | 280 |
| 8-118 | Same as item 8-116, but **C P.** | Each | 212 |
| 8-119 | Same as item 8-116 or 8-117 or 8-118, but fixing only. | Each | 114 |
| 8-120 | Same as item 8-116 to 8-119, if fixed in repairs. | Each | 42 |
| 8-121 | Supply and fix, **CP bow handle** 250 mm overall for Swing door. | Each | 414 |
| 8-122 | Same as item 8-121, but **Brass.** | Each | 623 |
| 8-123 | Same as item 8-121 or 8-122, but fixing only. | Each | 124 |
| 8-124 | Same as item 8-121 to 8-123, if fixed in repair. | Each | 42 |
| 8-125 | Supply and fix, **CP drawer handle,** 75mm grip. | Each | 174 |
| 8-126 | Same as item 8-125, but **Brass.** | Each | 170 |
| 8-127 | Same as item 8-125 or 8-126, but fixing only. | Each | 72 |
| 8-128 | Same as item 8-125 to 8-127, if fixed in repairs. | Each | 32 |
| 8-129 | Supply and fix, **CP drawer handle,** 100mm over all. | Each | 134 |
| 8-130 | Same as item 8-129, but **Brass.** | Each | 182 |
| 8-131 | Same as item 8-129 or 8-130, but fixing only. | Each | 72 |
| 8-132 | Same as item 8-129 to 8-131, if fixed in repairs. | Each | 32 |
| 8-133 | Supply and fix, **CP Flush pattern handle** with dished plated 75mm grip. | Each | 177 |
| 8-134 | Same as item 8-133, but **Brass.** | Each | 254 |
| 8-135 | Same as item 8-133 or 8-134, but fixing only. | Each | 72 |
| 8-136 | Same as item 8-133 to 8-135, but fixed in repairs. | Each | 32 |
| | **Hooks** | | |
| 8-137 | Supply and fix, **CP hat pegs,** 125 mm or over. | Each | 82 |
| 8-138 | Same as item 8-137, but **Brass.** | Each | 87 |
| 8-139 | Same as item 8-137 or 8-138, but fixing only. | Each | 30 |
| 8-140 | Add to item 8-137 to 8-139, if fixed in repairs. | Each | 25 |
| 8-141 | Supply and fix, **CP h t and coat hooks,** 175 mm or over. | Each | 132 |
| 8-142 | Same as item 8-141, but **Brass.** | Each | 276 |
| 8-143 | Same as item 8-141 or 8-142, but fixing only. | Each | 35 |
| 8-144 | Add to item 8-141 to 8-143, if fixed in repairs. | Each | 15 |
| 8-145 | Supply and fix, **CP hook for wardrobe (Single),** 56 mm long. | Each | 97 |
| 8-146 | Same as item 8-145 but **Brass.** | Each | 132 |
| 8-147 | Same as item 8-145 or 8-146, but fixing only. | Each | 36 |
| 8-148 | Add as item 8-145 to 8-147, if fixed in repairs. | Each | 15 |
| | **Screws - Wire Pattern** | | |
| 8-149 | Supply and fix, **Brass screw wire pattern, 50 mm.** | Each | 64 |
| 8-150 | Same as item 8-149 but , **100 mm.** | Each | 80 |
| 8-151 | Same as item 8-149 but, **150 mm.** | Each | 126 |
| 8-152 | Same as item 8-149 to 8-151 but fixing only. | Each | 32 |
| 8-153 | Add to item 8-149 to 8-152, if fixed in repairs. | Each | 15 |

| Sl No | Description | Unit | Rate(Rs) |
|---|---|---|---|
| | **Knobs** | | |
| 8-154 | Supply and fix, **Steel knobs 30 mm** for cupboard having screwed end. | Each | 97 |
| 8-155 | Same as item 8-154, but fixing only. | Each | 25 |
| 8-156 | Add to item 8-154 or 8-155, if fixed in repairs. | Each | 13 |
| 8-157 | Supply and fix, **Brass knob 30 mm** for cupboard with nut screw and rose. | Each | 146 |
| 8-158 | Same as item 8-157, but **CP.** | Each | 122 |
| 8-159 | Same as item 8-157 or 8-158, but fixing only. | Each | 25 |
| 8-160 | Add to item 8-157 or 8-158 or 8-159, if fixed in repairs. | Each | 13 |
| 8-161 | Supply and fix, **Brass knob 70 mm** with screws bolt and nut for front door?. | Each | 146 |
| 8-162 | Same as item 8-161, but **CP.** | Each | 133 |
| 8-163 | Same as item 8-161 or 8-162, but fixing only. | Each | 25 |
| 8-164 | Add to item 8-161 to 8-163, if fixed in repairs. | Each | 13 |
| 8-165 | Supply and fix, **Wooden knob 50 mm or 56 mm** having polished hard wood tapped end with screws. | Each | 82 |
| 8-166 | Same as item 8-165, but fixing only. | Each | 25 |
| 8-167 | Add to items 8-165 or 8-166, if fixed in repairs. | Each | 13 |
| | **Hasp and Staple** | | |
| 8-168 | Supply and fix, **CP Hasp and Staple,** hinged to plate overall length 100mm. | Each | 176 |
| 8-169 | Same as item 8-168, but **Brass.** | Each | 182 |
| 8-170 | Same as item 8-168 or 8-169, but fixing only. | Each | 67 |
| 8-171 | Add to item 8-168 to 8-170, if fixed in repairs. | Each | 53 |
| | **Spring For Doors** | | |
| 8-172 | Supply and fix, **150 mm Helical steel spring** for doors. | Each | 461 |
| 8-173 | Same as item 8-172, but **Brass.** | Each | 552 |
| 8-174 | Same as item 8-172, but **CP.** | Each | 411 |
| 8-175 | Same as item 8-172 to 8-174, but fixing only. | Each | 98 |
| 8-176 | Add to item 8-172 to 8-175, if fixed in repairs. | Each | 42 |
| | **Turns - Cupboards** | | |
| 8-177 | Supply and fix, **Brass knob** 40mm dia with rose spindle turns and screws. | Each | 191 |
| 8-178 | Same as item 8-177, but **CP.** | Each | 181 |
| 8-179 | Same as item 8-177 or 8-178, but fixing only. | Each | 84 |
| 8-180 | Add to item 8-177 to 08-179, if fixed in repairs. | Each | 42 |
| | **Poles for Curtains etc.** | | |
| 8-181 | Supply and fix, **1st class Soft wood (Deodar) ends 75 mm to 100 mm square** for curtain poles including steel screws etc. | Each | 260 |
| 8-182 | Supply and fix of **25 mm dia stainless steel pipe** with any colour, design and texture fancy type for curtains with brackets, ends, hooks etc. complete. | Metre | 240 |
| 8-183 | Same as item 8-181 to 8-182, but fixing only. | Each | 83 |
| 8-184 | Add to item 8-181 to 8-183, if fixed in repairs. | Each | 50 |
| 8-185 | Supply and fix, **brackets strong cast Brass** for curtain poles of any dia. | Pair | 785 |
| 8-186 | Same as item 8-185, but fixing only. | Pair | 90 |
| 8-187 | Add to item 8-185 or 8-186, if fixed in repairs. | Pair | 42 |
| 8-188 | Supply and fix **Ring type curtain rods** with suitable brackets and end fittings, complete all as specified. | Metre | 203 |
| | **Push and Kick Plates** | | |
| 8-189 | Supply and fix, **Brass or Copper push plate** exceeding 160 sqcm in area (16-18 gauge). | Each | 544 |

| Sl No | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 8-190 | Same as item 8-189, but **Stainless steel.** | Each | 364 |
| 8-191 | Same as item 8-189, but **CP.** | Each | 362 |
| 8-192 | Same as item 8-189 to 8-191, but fixing only. | Each | 61 |
| 8-193 | Add to item 8-189 to 8-192, if fixed in repairs. | Each | 25 |
| 8-194 | Supply and fix, **Brass or Copper kick plate** (16-18 gauge). | Sqm | 9931 |
| 8-195 | Same as item 8-194, but **Stainless Steel.** | Sqm | 3112 |
| 8-196 | 3ame as item 8-194, but **CP.** | Sqm | 6886 |
| 8-197 | Same as item 8-194 to 8-196, but fixing only. | Sqm | 276 |
| 8-198 | Add to item 8-194 to 8-197, if fixed in repairs. | Sqm | 222 |
| | **Knob Lock** | | |
| 8-199 | Supply and fix, **knob lock CP,** 150 mm long. | Each | 380 |
| 8-200 | Same as item 8-199, but fixing only. | Each | 224 |
| 8-201 | Add to item 8-199 or 8-200, if fixed in repairs. | Each | 32 |
| | **Aluminium / uPVC Door Lock and Closer** | | |
| 8-202 | Supply and fix, **Aluminium door lock, Standard model,** Anodized Bronze. | Each | 415 |
| 8-203 | Same as item 8-202 but **Deluxe model.** | Each | 457 |
| 8-204 | Same as item 8-202 but **Premium model.** | Each | 608 |
| 8-205 | Supply and fix, **Aluminium door closer, Deluxe Model,** Anodized Bronze. | Each | 2658 |
| 8-206 | Same as item 8-205 but **Premium model.** | Each | 3020 |
| 8-207 | Supply and fix, **Floor Concealed Door Closer** (swing machine, single/double action), for door width upto1250mm with load bearing range upto 150 kg, all as specified. | Each | 12197 |
| 8-208 | Supply and fix **Aluminium door Handle,** Anodized bronze in any design and pattern. | Each | 525 |
| 8-209 | Supply and fix **uPVC door hinges,** all as specified. | Each | 4431 |
| 8-210 | Supply and fix **uPVC door handle,** all as specified. | Each | 1058 |
| 8-211 | Supply and fix **uPVC door lock,** all as specified. | Each | 5025 |
| | **Door Stopper/Linings** | | |
| 8-212 | Supply and fix, **rubber linings to door** with screw etc. | Metre | 134 |
| 8-213 | Supply and fix, **Magnetic door stopper** on wall or floor of any type. | Each | 202 |

# SECTION-9

## STEEL. **AND IRON WORK**

# RECORDOFAMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-9

# STEEL AND IRON WORK

## SPECIFICATIONS

**9.0.** The work covered under this section consists of steel / iron items like angle, tee, joist / girder, reinforcement bars, pre-stressed reinforcement, plain, galvanized sheets, bolts and nuts, wire fencing, Galvanized Iron (G.I) wires, woven wires, netting, Cast Iron (CI) and welding works etc.

## MATERIAL REQUIREMENTS

**9.1. Plain Corrugated Steel sheeting.** Shall be of the best quality specified for corrugated steel sheeting.

**9.2. Galvanizing.** Shall be a thorough even coat of zinc, free from stains, bare spots or defects, conforming to **ASTM standards A653 / A653M.**

**9.3. Cast iron Casting.** Shall be clean, sound and free from air holes.

**9.4. Steel and Iron** include **Cast Iron.**

9.4.1. Steel shall:-

(1) Comply with BS No 15 or compatible ASTM standards.

(2) Be obtained from approved source.

(3) Be of tested quality, where required without extra charge.

9.4.2. Mild Steel shall comply with relevant BS.

9.4.3. For Steel reinforcement, **deformed bars** shall conform to ASTM A-615, **Ribbed and Tor steel bars** shall comply with BS-4461.

9.4.4. **Physical Properties.** As described in Table 9-1.

**TABLE 9-1**
**Tensile Requirements**

| Type | Grade 40 | Grade 60 |
|---|---|---|
| **Yield Strength, minimum** | **40,000 Psi** 2,812 Kg/ Sq. cm, 276 N/mm$^2$ | **60,000 Psi** 4,218 Kg/ Sq. cm, 414 N/mm$^2$ |
| **Ultimate Tensile Strength, minimum** | **70,000 Psi** 4,921 Kg / Sq. cm, 485 N/mm$^2$ | **90,000 Psi** 6,330 Kg / Sq. cm, 624 N/mm$^2$ |

**9.5.** The weight of **Mild, Ribbed or Tor steel bars** will be calculated at rates specified in Table 9-2, with a tolerance of upto 5% either way.

**TABLE 9-2**
**WEIGHT OF STEEL**

| METRIC | | | IMPERIAL | | |
|---|---|---|---|---|---|
| **Dia (mm}** | **Sectional area (Sq. cm}** | **Weight (Kg per M}** | **Dia (inches}** | **Section Area (Sq. cm}** | **Weight (Kg per M}** |
| 6 | 0.283 | 0.222 | ¼" | 0.317 | 0.248 |
| 8 | 0.502 | 0.395 | 3/8" | 0.713 | 0.559 |
| 10 | 0.785 | 0.617 | ½" | 1.267 | 0.995 |
| 12 | 1.131 | 0.888 | 5/8" | 1.979 | 1.554 |
| 16 | 2.011 | 1.578 | ¾" | 2.850 | 2.237 |
| 18 | 2.545 | 2.000 | 7/8" | 3.879 | 3.045 |
| 22 | 3.801 | 2.980 | 1" | 5.067 | 3.978 |
| 25 | 4.909 | 3.854 | 1 1/8" | **6.413** | 5.034 |
| 28 | 6.157 | 4.830 | 1 ¼" | 7.917 | 6.215 |
| 32 | 8.042 | 6.313 | 1 3/8" | 9.580 | 7.520 |
| 35 | 10.179 | 7.990 | 1 ½" | 11.401 | 8.950 |
| 40 | 12.566 | 9.864 | | | |
| 50 | 19.635 | 15.410 | | | |

**9.6. Pre-stressing Reinforcement Steel.** Pre-stressing Steel shall be High-Tensile Wire grade 250-K, 270-K (Joint less quality) conforming to ASTM Specification A-421; Strand or Rope conforming to ASTM Specification A-416 or High Tensile Alloy bars, as per Table 9 - 3 :-

**TABLE 9-3**

| Description | Strength Kg /Sq cm (Psi) |
|---|---|
| Minimum Ultimate tensile strength | 16,570 (235,000) |
| Minimum Yield strength, measured by 0.7 % extension under Load method shall be not less than | 9,100 (130,000) |
| Minimum Modulus of Elasticity | **$1.75 \times 10^6$** (25,000,000) |
| Minimum Elongation in 20 bar dia length | 4% |
| Dia after rupture | -0.75 mm |
| Dia tolerance | -0,25 mm |

**9.7. High-Tensile-Strength Alloy bars** shall be stress relieved and cold stretched to a min of 9,100 Kg/ Sq cm. After cold stretching, the physical properties shall be as per Table 9 - 4:-

**TABLE 9-4**

**Weight of Wire with smooth / indented surface**

| Nominal Dia (mm) | Nominal Cross Section (mm) | Nominal Tensile Strength ($N/mm^2$) | Minimum Breaking Load (kN) | Modulus of Elasticity ($kN/mm^2$) | Nominal Weight per 1000 M (Ka) |
|---|---|---|---|---|---|
| 3.0 | 7.07 | 1770<br>1860 | 12.5<br>13.1 | 195±10 | 56 |
| 4.0 | 12.6 | 1670<br>1770 | 21.0<br>22.3 | | 99 |
| 5.0 | 19.6 | 1670<br>1770 | 32.7<br>34.7 | | 154 |
| 5.5 | 23.8 | 1670<br>1770 | 39.7<br>42.1 | | 187 |
| 6.0 | 28.3 | 1670<br>1770 | 47.2<br>50.1 | | 222 |
| 7.0 | 38.5 | 1670<br>1770 | 64.3<br>68.1 | | 302 |
| 7.5 | 44.2 | 1670 | 73.8 | | 346 |
| 8.0 | 50.3 | 1570 | 78.9 | | 395 |
| 9.4 | 69.4 | 1570 | 108.9 | | 545 |
| 12.2 | 116.9 | 1570 | 183.5 | | 918 |

Note:

(1) The steel shall be free from injurious defects and shall have a smooth surface. The Material that shows defect / damage / injury during or prior to installation in the work shall be rejected.

(2) Wire and strand shall be supplied in coils of sufficient diameter to ensure that they lie out straight, when opened.

(3) Engineer-in-Charge may call for a relaxation test on pre-stressing steel, in case he is not satisfied with the source of manufacture. Relaxation for pre-stressing steel shall be measured over a period of thousand (1000) hours stressed at seventy percent (70%) of its ultimate tensile strength giving less than six percent (6%) elongation and also follow ASTM standard E328.

**9.8. Bolts and Nuts shall be confirming to ASTM Standards:-**

(1) Steel Whit Worth standard pattern

(2) Forged with heads in one piece

(3) Threaded for required lengths

(4) With full, true, deep threads

**9.9. Testing**

9.9.1. All wires, strands, or bars and Anchorage assemblies to be shipped to the site shall be assigned a lot number and tagged for identification purposes.

9.9.2. All samples submitted shall be representative of the lot to be furnished.

9.9.3. All of the materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of anticipated time of use.

9.9.4. The contractor shall furnish for testing the samples selected from each lot as ordered by the Engineer-in-Charge. The selection of samples shall be made at the manufacturer's plant by the Engineer-in-Charge or his representative.

## CONSTRUCTION REQUIREMENTS

**9.10. Wire Netting** shall be of galvanized iron (GI) in any width, required from 300 mm to 1800 mm, fixed with galvanized wire staples etc., complete. It shall be minimum 25 mm mesh, 14 SWG

**9.11. Mild Steel.** All forgings shall be neatly and soundly made to the dimensions given. Bolts holes may be punched unless ordered to be drilled.

**9.12. Expended Material (XPM).** It shall be 25mm x 25mm mesh or 38mm x 40mm mesh (16 or 18 gauge).

**9.13.** Drilling, punching, forging, screwing, bolting etc., shall be done in a sound and workman like manners.

**9.14. Painting.** Steel work, which will be exposed, shall be thoroughly cleaned and receive one coat of linseed oil or Oxide of Iron paint at work, before bolting. For additional painting refer to Section 15.

**9.15. Steel work** in contact with brick or block masonry to be grouted with cement.

**9.16.** Steel work to be buried in Concrete work shall be scraped free from oil, scale or loose rust, with a stiff wire brush, before it is placed in position and, except in the case of reinforcement bars, shall be given one coat of cement wash.

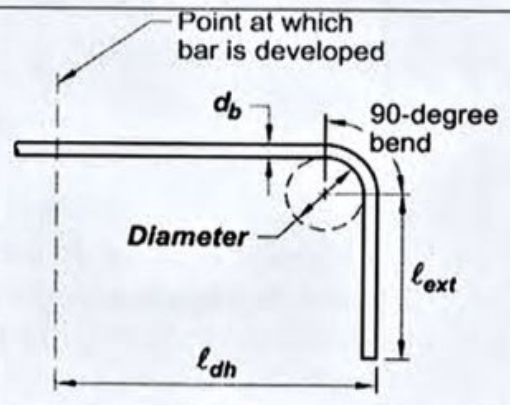
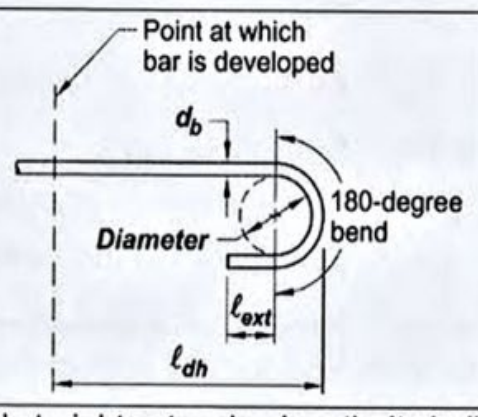
### 9.17. Reinforcement

9.17.1. All reinforcing bars shall be bent cold and tied with 16 SWG wire, to keep correct position in centering.

9.17.2 Lengthening of bars will not be done by welding. Deformed Bars connected longitudinally are to have the ends bent over the bars to overlap for a length equal to not less than **24 dia in compression** e.g. in columns and the like, and **45 dia in tension** e.g. beams and the like, and to be securely wired and should conform to latest ACI code requirements as shown in the Table 9-5 and Table 9-6 and below.

**TABLE 9-5**

**Standard hook geometry for development of deformed bars in tension**

| Type of standard hook | Bar size | Minimum inside bend diameter, in. | Straight extension (1) $l_{ext}$, in | Type of Standard hook |
|---|---|---|---|---|
| 90- degree hook | No. 3 through No. 8 | $6d_b$ | $12d_b$ |   |
| | No. 9 through No. 11 | $8d_b$ | | |
| | No. 14 and No. 18 | $10d_b$ | | |
| 180 – degree hook | No. 3 through No. 8 | $6d_b$ | Greater of $4d_b$ and 2.5 m. |   |
| | No. 9 through No. 11 | $8d_b$ | | |
| | No. 14 and No. 18 | $10d_b$ | | |

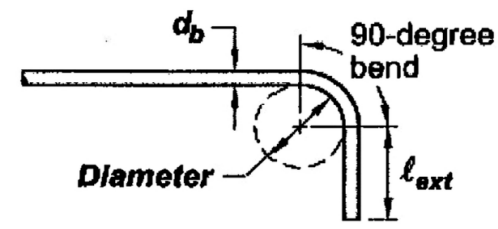
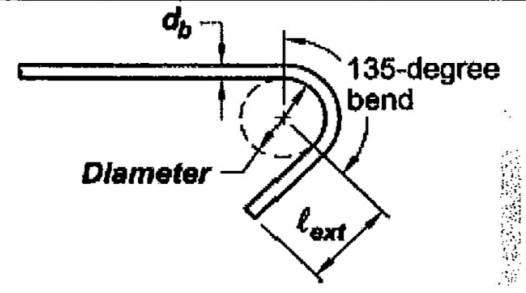
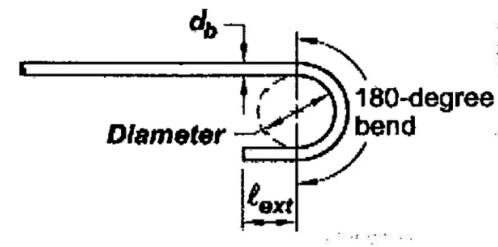
(1)A standard book for deformed bars in tension includes the specific bend diameter and straight extension length. It shall be permitted to use a longer straight extension at the end of hook. A longer extension shall not be considered to increase the anchorage capacity of the hook.

**LAP LENGTHS FOR BARS IN TENSION**

| Location | fc' = 3000 psi fv = 60000 psi | | fc' = 4000 psi fy = 60000 psi | | fc' = 3000 psi fv = 40000 osi | | fc' = 4000 psi fy = 40000 psi | |
|---|---|---|---|---|---|---|---|---|
| | LAP LENGTH | | LAP LENGTH | | LAP LENGTH | | LAP LENGTH | |
| | #6& SMALLER | #7 & LARGER | #6& SMALLER | #7& LARGER | #6& SMALLER | #7 & LARGER | #6 & SMALLER | #7 & LARGER |
| Horizontal/ Vertical Bars | 58db | 72db | 50db | 62db | 39db | 48db | 34db | 42db |
| Inclined Bars | 75db | 92db | 64db | 80db | 50db | 62db | 43db | 54db |

**TABLE 9-6**

**Minimum inside bend diameters and standard hook geometry for stirrups, ties, and hoops**

| Type of standard hook | Bar size | Minimum inside bend diameter, in. | Straight extension (1) $l_{ext}$, in | Type of Standard hook |
|---|---|---|---|---|
| 90- degree hook | No. 3 through No. 5 | $4d_b$ | Greater of $6d_b$ and 3 in. |   |
| | No. 6 through No. 8 | $6d_b$ | $12d_b$ | |
| 135 – degree hook | No. 3 through No. 5 | $4d_b$ | Greater of $6d_b$ and 3 in. |   |
| | No. 6 through No. 8 | $6d_b$ | | |
| 180 – degree hook | No. 3 through No. 5 | $4d_b$ | Greater of $4d_b$ and 2.5 in. |   |
| | No. 6 through No. 8 | $6d_b$ | | |

(1) A standard book for deformed bars in tension includes the specific bend diameter and straight extension length. It shall be permitted to use a longer straight extension at the end of hook. A longer extension shall not be considered to increase the anchorage capacity of the hook.

## METHOD OF MEASUREMENTS

**9.18. Tolerances.** Linear work shall be measured to nearest cm.

**9.19.** Superficial work

(1) Length as above.

(2) Width to the nearest cm.

**9.20. Steel Bar Reinforcement.** Shall be measured gross. Lap shall be measured and hook girth, saddles {chairs) and weight added to the total weight. Patent reinforcement {expanded metal) shall be measured net with no allowance for laps.

**9.21.** All work (except steel reinforcement) shall be measured net and flat {not girthed) as fixed.

**9 22. Corrugated and Plain Sheets.** Shall be measured net and no allowance made for laps or welts, sheets cut to shape shall be measured overall the least dimension out of which can be cut.

**9.23. Bolts.** Shall be measured {net length) x fixed girth.

## CLARIFIICATION OF RATES

**9.24.** The rates, inter alia, include particularly:-

(1) Reducing to size, shape, figure, etc., including rolls, welts, seams and all straight cutting and waste.

{2) All holes, screw bolts, nuts washers, packing pieces, wedges, if and where required and grouting, as necessary.

(3) True and square ends neatly cut and fitted notches.
(4) All necessary templates, patterns, moulds, etc.
(5) Jointing etc., for pipe work.
(6) Scraping reinforcement, as specified, and all bends, cranks, hooks, spirals, loops and tying wire, supporting and maintaining in position.
(7) Painting all Iron and Steel work with one coat of Red Oxide paint, before fixing and coat of paint after fixing. All Steel and Iron in contact with brickwork or concrete will be given a coat of cement slurry.

**Exception:** - Sheet steel work, sheet iron pipe, reinforcement and galvanized work.

(8) Mortises, holes, plugs etc., in concrete, brick or stone work and making good.
(9) Hoisting, erection etc., complete as required.
(10) Fixing / Erection only will also include two coats of paint as specified above.
(11) Welding in lieu of bolting etc.
(12) For more or less cross sectional area of welding, the existing rate shall be increased or decreased proportionally.
(13) Concertina/ Razor wire 12 gauge galvanized, single coil/cross type, loop dia 0.991 M@ 10 Kg per 5.86 Min length.
(14) Concertina *I* Razor wire 12 gauge galvanized, single coil/cross type, loop dia 0.700 M @ 10 Kg per 10.66 M in length.
{15) Concertina /Razor wire 12 gauge galvanized, single coil/cross type, loop dia 0.450 M @ 10 Kg per 13.71 Min length.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Structural Steel Works** | | |
| 9-1 | Supply and fix, **joist, channel, angle or tee sections,** fixed independently without connecting plates etc., cut to ordinary length. | Kg | 159 |
| 9-2 | Same as item 9-1, but erection only. | Kg | 12 |
| 9-3 | Add to item 9-1 or 9-2, if fixed in repairs. | Kg | 7 |
| 9-4 | Supply and fix **purlins, hips and the like,** main and cross beams or grids with angle cleats or other connecting plates, cut to dead length where required. | Kg | 167 |
| 9-5 | Same as item 9-4, but erection only. | Kg | 16 |
| 9-6 | Add to item 9-4 or 9-5, if fixed in repairs. | Kg | 10 |
| 9-7 | Supply and fix, **built up girders, ordinary and compound stanchion** for wheel runs, platforms, gate/door coverings including screws bolts and nuts etc., or welding etc. | Kg | 167 |
| 9-8 | Same as item 9-7, but erection only. | Kg | 16 |
| 9-9 | Add to item 9-7 or 9-8, if fixed in repairs. | Kg | 10 |
| 9-10 | Supply and fix, **roof trusses, framed structure, walls, pieces,• purlins,** cleats, etc. and all connections including welding etc. | Kg | 181 |
| 9-11 | Same as item 9-10, but erection only. | Kg | 30 |
| 9-12 | Add to item 9-10 or 9-11, if fixed in repairs. | Kg | 18 |
| 9-13 | Supply and fix, **framed stair cases, framed doors and gates prepared for attachment of coverings** including hooks, hinges sliding or hanging door fittings, fastenings (except locks), hanging and fixed complete. (Coverings to be paid extra as supply and fix) including welding in lieu of bolting etc. | Kg | 206 |
| 9-14 | Same as item 9-13, but erection only. | Kg | 38 |
| 9-15 | Same as item 9-13 or 9-14, if fixed in repairs. | Kg | 23 |
| | **General Steel Works** | | |
| 9-16 | Supply and fix, holds fast, guard bars, straps or wooden trusses, holding down bolts with washers, ladders, railing, brackets, pipe supports, tie rods and balusters, chimney bars, chains, rings shackles, hinges any type, gratings or gullies, etc., including forging, letting into stone or brick work etc. complete by welding in lieu of bolting etc. | Kg | 237 |
| 9-17 | Same as item 9-16, but erection only. | Kg | 70 |
| 9-18 | Same as item 0-16 or 0-17, if fixed in repairs. | Kg | 42 |
| 9-19 | Supply and fix **Wind ties** including punching and fixing in any position complete. | Kg | 188 |
| 9-20 | Same as item 9-19, but erection only. | Kg | 41 |
| 9-21 | Same as item 9-19 or 9-20, if fixed in repairs. | Kg | 25 |
| 9-22 | Supply and fix, guard bars, grills, railing, ladders brackets, hooks hold fasts and frames etc., cut to dead length, reduced to size, shape, figure etc., including punching/drilling holes if necessary and fixing, assembling by welding or with the use of bolts, nuts, rivets washers etc., and erection/fixing in position including making good the disturbed surface. | Kg | 221 |
| 9-23 | Same as item 9-22, but erection only. | Kg | 64 |
| 9-24 | Add to item 9-22 or 9-23, if fixed in repairs. | Kg | 38 |
| 9-25 | Supply and fix, **small articles, weighing under 1 Kg,** hammered from the anvil, heated if necessary, reduced to any size or figure required, including drilling, punching, welding and roughly filled if necessary (Articles which cannot be measured but can only be weighed). | Kg | 325 |
| 9-26 | Same as item 9-25, but weighting 1 Kg and over, upto 3 Kg. | Kg | 255 |
| 9-27 | Same as item 9-25 or 9-26, but erection only. | Kg | 96 |
| 9-28 | Add to item 9-25 or 9-26 or 9-27, if fixed in repairs. | Kg | 58 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Welding** | | |
| 9-29 | **Gas welding** of **MS** or WI, 9 Sq mm. | Metre | 476 |
| 9-30 | **Electric welding** of **MS** or WI, 9 Sq mm **Screw Bolts.** | Metre | 180 |
| 9-31 | Supply and fix, **bolts** not exceeding 10 mm dia and length not exceeding 75 mm, with hexagon, including square, cup or cheese heads, screwed one washer and one hexagon or square nut. | Each | 31 |
| 9-32 | Same as Item 9-31, but length exceeding 75 mm and not exceeding 150mm. | Each | 36 |
| 9-33 | Same as item 9-31 or 9-32, but length exceeding 150 mm and not exceeding 300 mm. | Each | 78 |
| 9-34 | Same as item 9-31 or 9-32 or 9-33, but fixing only. | Each | 6 |
| 9-35 | Add to item 9-31 to 9-34, if fixed in repairs. | Each | 3 |
| 9-36 | Supply and fix, **bolts** exceeding 10mm, but not exceeding 18 mm dia and length not exceeding 75mm, with hexagon, square, cup or cheese heads, screwed one or both ends, of one end enlarged or jagged or lewised, each with one washer and one hexagon or square nut. | Each | 77 |
| 9-37 | Same as item 9-36, but length exceeding 75mm and not exceeding 150mm. | Each | 83 |
| 9-38 | Same as item 9-36, but length exceeding 150mm and not exceeding 300mm. | Each | 114 |
| 9-39 | Same as item 9-36 or 9-37 and 9-38, but fixing only. | Each | 7 |
| 9-40 | Add to item 9-36 to 9-39, if fixed in repairs. | Each | 4 |
| 9-41 | Supply and fix, **bolts** exceeding 18mm but not exceeding 25 mm dia and length not exceeding 75mm with hexagon, square, cup or cheese heads, screwed one or lewised each with one washer and one hexagon/square nut. | Each | 132 |
| 9-42 | Same as item 9-41, but length exceeding 75mm and not exceeding 150mm. | Each | 216 |
| 9-43 | Same as item 9-41, but length exceeding 150 mm and not exceeding 300mm. | Each | 276 |
| 9-44 | Same as item 9-41or 09-42 and 09-43, but fixing only. | Each | 11 |
| 9-45 | Add to item 9-41 to 9-44, if f1Xed in repairs. | Each | 07 |
| | **Galvanizing** | | |
| 9-46 | **Galvanizing light articles** (weight not exceeding 3 Kg each}. | Kg | 45 |
| 9-47 | **Galvanizing, iron/ steel work** (not el$ewhere provided) any description, area galvanized measure flat (not girths). | Sqm | 277 |
| | **Cast Iron (CI) work** | | |
| 9-48 | Supply and fix, **CI work** weight not exceeding 6 Kg un-machined in brackets, gully traps gratings, frames, fire doors, stop cock boxes, manhole covers and the like. | Kg | 437 |
| 9-49 | Same as item 9-48, but weight exceeding 6 Kg. | Kg | 462 |
| 9-50 | Supply and fix, **CI work** weight not exceeding 6kg, machine turned, as in pulleys etc. | Kg | 557 |
| 9-51 | Same as item 9-50, but weight exceeding 6 Kg, as specified. | Kg | 687 |
| | **Steel Reinforcement** | | |
| 9-52 | Supply and fix, **bars** round, square or flat including cutting, bending, binding and placing reinforcement in position. | Kg | 146 |
| 9-53 | Same as item 9-52, except cost of bars. | Kg | 11 |
| 9-54 | Supply and fix, **bars round, using deformed bars Grade-40** inclutjing cutting, bending, binding and placing reinforcement in position. | Kg | 151 |
| 9-55 | Same as item 9-54, except cost of bars. | Kg | 11 |
| 9-56 | Supply; .and fix, **bars round,** using **deformed bars Grade-60,** including cutting, bending, binding and placing reinforcement in position. | Kg | 154 |
| 9-57 | Same as item 9-56, except cost of bars. | Kg | 11 |
| 9-58 | Supply and fix, **bars round using ribbed, tor steel** including cutting, bending, binding and placing reinforcement in position. | Kg | 152 |
| 9-59 | Same as item 9-58, except cost of bars. | Kg | 11 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 9-60 | Supply and fix, **Steel Reinforcement for pre-stressed concrete** as in beams, girders etc., including post-tensioning, all as specified | Kg | 361 |
| 9-61 | Same as item 9-60, .except cost of bars. | Kg | 70 |
| 9-62 | Add to item 9-52, 9-54, 9-56 and 9-58 for each additional lift for each storey above 2nd floor roof level, all as specified. | Kg | 7 |
| 9-63 | Supply and fix, **XPM** (expended metal), 38 mm x 44 mm mesh **(18 gauge)** BRC fabric weld-mesh, max-weld etc., in reinforcement or in other positions like doors, partition and lathing for plaster, to shape and size as required, including binding with 14 SWG wire, nails staples tc., and placing in position, measured net. | Sqm | 368 |
| 9-64 | Same as Item 9-63, but 25 mm x 25 mm mesh. | Sqm | 504 |
| 9-65 | Same as item 9-63 but **(16 gauge).** | Sqm | 449 |
| 9-66 | Same as Item 9-65 but 25 mm x 25 mm mesh. | Sqm | 613 |
| 9-67 | S me as item 9-65 or 9-66, but except cost of fabric etc. | Sqm | 95 |
| | **Plain Sheeting** | | |
| 9-68 | Supply and fix, **GI sheets, 24 BG** in walls, floors, ceiling etc. | Sqm | 1197 |
| 9-69 | Same as item 9-68, but **22 BG.** | Sqm | 1442 |
| 9-70 | Same as item 9-68, but **20 BG.** | Sqm | 1694 |
| 9-71 | Same as item 9-68, but **18 BG.** | Sqm | 2053 |
| 9-72 | Same as item 9-68 to 9-71, but fixing only. | Sqm | 145 |
| 9-73 | Supply and fix, **GI sheets 24 BG** in hearts, troughs, protection sheets behind stoves, coverings to frames and doors including edges sleeve pieces, curb to hearths, over wooden cores, edges mangers etc. | Sqm | 1379 |
| 9-74 | Same as item 9-73, but **22 BG.** | Sqm | 1640 |
| 9-75 | Same as item 9-73, but **20 BG.** | Sqm | 1904 |
| 9-76 | Same as item 9-73, but **18 BG.** | Sqm | 2267 |
| 9-77 | Same as item 9-73 to 09-76, but fixing only. | Sqm | 283 |
| 9-78 | Supply and fix, **pipes of Galvanized sheets 20 BG,** any dia, welded side joints (fixed length to nearest 15mm) | Sqm | 1826 |
| 9-79 | Same as item 9-78 but **18 BG.** | Sqm | 2133 |
| 9-80 | Same as item 9-78 and 9-79 but fixing only. | Sqm | 276 |
| 9-81 | Supply and fix, **cowl, elbows of Galvanized sheets 20 BG,** (canister with soot door) bends, taped, oval short pieces for ranges.) | Each | 809 |
| 9-82 | Same as item 9-81 but **18 BG.** | Each | 833 |
| 9-83 | Same as item 9-81 and 9-82 but fixing only. | Each | 85 |
| | **Hoop Iron** | | |
| 9-84 | Supply and fix, **hoop iron,** 25mm, 18 BG at 0.07 Kg/M in any position (not elsewhere stated) including laps etc., as required. | Metre | 83 |
| 9-85 | Same as item 9-84, but of galvanized sheets. | Metre | 94 |
| 9-86 | Same as item 9-84, but 40 mm, 16 BG at 0.15 Kg/ M. | Metre | 108 |
| | **Wire for Fencing** | | |
| 9-87 | Supply and fix, **barbed wire, galvanized 12 gauge,** 2 strands 4 points barbs at 75 mm apart fixed with staples, nails etc., and connect up ends complete. | Metre | 91 |
| 9-88 | Same as item 9-87, but **14 gauge.** | Metre | 73 |
| 9-89 | Same as item 9-87 or 09-88, but fixing only. | Metre | 49 |
| 9..90 | Restraining and re-securing, barbed wire fixed with staples, nails etc., and connect up ends complete or taking down and removing to stores per strand. | Metre | 31 |
| 9-91 | Supply and fix, **16 SWG galvanized plain wire** in any position. | Metre | 15 |
| 9-92 | Same as item 9-91, but **14 SWG.** | Metre | 17 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 9-93 | Same as item 9-91, but **12 SWG.** | Metre | 22 |
| 9-94 | Same as item 9-91, but **8 SWG.** | Metre | 32 |
| 9-95 | Same as item 9-91 to 9-94, but fixing only. | Metre | 07 |
| 9-96 | Add to item 9-91 to 9-95, if fixed in repairs. | Metre | 4 |
| | **Woven Wire Work etc** | | |
| 9-97 | Supply and fix, **Wire Netting,** Iron galvanized **50 mm x 50 mm mesh, 14 SWG** and fixed with tinned tacks, G.I staples etc., all as required. | Sqm | 333 |
| 9-98 | Same as item 9-97 but **40 mm x 40 mm mesh** as specified. | Sqm | 572 |
| 9-99 | Same as item 9-97 but **25 mm x 25 mm mesh** as specified. | Sqm | 613 |
| 9-100 | Supply and fix, Wire Netting, Iron galvanized 75 mm x 75 mm mesh, **12 SWG** and fixed with tinned tacks, G.I staples etc., as required. | Sqm | 383 |
| 9-101 | Same as item 9-100 but **50 mm x 50 mm mesh** as specified. | Sqrrf | 449 |
| 9-102 | Same as item 9-100 but **40 mm x 40 mm mesh** as specified. | Sqrif | 613 |
| 9-103 | Same as item 9-100 but **25 mm x 25 mm mesh** as specified. | Sqm | 845 |
| 9-104 | Supply and fix, **Wire Netting,** Iron galvanized **75 mm x 75 mm mesh, 10 SWG** and fixed with tinned tacks, G.I staples etc., all as required. | Sqm | 481 |
| 9-105 | Same as item 9-104 but **50 mm x 50 mm of mesh** as specified. | Sqm | 443 |
| 9-106 | Same as item 9-97 to 9-105, but fixing only. | Sqm | 40 |
| 9-107 | Add item 9-97 or 9-106, if fixed in repair. | Sqm | 24 |
| | **Concertina / Razor Wire** | | |
| 9-108 | Supply and fix, **Concertina Wire / Razor wire,** single coil, 12 gauge galvanized wire, loop dia 0.452 to 0.990M, complete, all as specified. | Metre | 482 |
| 9-109 | Same as item 9-108, but fixing only. | Metre | 6 |
| 9-110 | Same as item 9-108 and 9-109, if fixed in repairs. | Metre | 4 |
| | **MS Hollow pipe** | | |
| 9-111 | Supply and fix **1"x1**", **MS hollow pipe square, 16 gauge** including welding/ jointing etc. | Metre | 387 |
| 9-112 | Same as item 9-111 but **1 1/4"x1 1/4",** all as specified. | Metre | 540 |
| 9-113 | Same as item 9-111 but **1 1/2"x1 1/2",** all as specified. | Metre | 616 |
| 9-114 | Same as item 9-111 but **2" x 2",** all as specified. | Metre | 700 |
| 9-115 | Same as item 9-111 but **3"x3",** all as specified. | Metre | 1313 |
| 9-116 | Supply and fix 1"x1 ", **MS hollow pipe square, 18 gauge** including welding/ jointing etc. | Metre | 424 |
| 9-117 | Same as item 9-116 but 1 1**/4"x1** 1**/4",** all as specified. | Metre | 464 |
| 9-118 | Same as item 9-116 but **11/2"x1 1/2",** all as specified. | Metre | 530 |
| 9-119 | Same as item 9-116 but **2" x 2",** all as specified. | Metre | 588 |
| 9-120 | Same as item 9-116 but **3"x3",** all as specified. | Metre | 855 |
| 9-121 | Supply and fix, 1 **1/2"x 1" MS hollow pipe rectangular, 16 gauge** including welding/ jointing etc. | Metre | 565 |
| 9-122 | Same as item 9-121 but **2"x 11/2",** all as specified. | Metre | 686 |
| 9-123 | Supply and fix, **1 1/2"x 1" MS hollow pipe rectangular, 18 gauge** including welding/ jointing etc. | Metre | 488 |
| 9-124 | Same as item 9-123 but 2"x 1 **1/2",** all as specified. | Metre | 588 |
| | **Stainless Steel Hand Railing** | | |
| 9-125 | Supply and fix, **Stainless steel Hand railing using 3/4" to 2" dia,16 to 18 Gauge pipe** with all fittings etc. as per specifications. | Metre | 3639 |

# SECTION -10

# ROOF COVERINGS AND ROOF TREATMENTS

# RECORD OF AMENDMENTS

| **Sl No** | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION -10

# ROOF COVERINGS AND ROOF TREATMENTS

## SPECIFICATIONS

**10.0.0.** This section consists of following sub sections:-

(1) Roof Coverings
(2) Water Proofing Treatment
(3) Roof Insulation

## SUB SECTION 10-1

## ROOF COVERINGS

**10.1.0.** This sub section consists of roof coverings of Corrugated Galvanized Iron (CGI), Mild Steel (MS), Fibre Glass, corrugated and plain sheets, including Ridge gutter and rain water pipes.

### MATERIAL REQUIREMENTS

**10.1.1. Corrugated Steel Sheeting**

10.1.1.1. The Sheets to be made of tough mild steel, well annealed, even in temper and thickness, free from holes, cracks, blisters and other defects.

10.1.1.2. The sheets to be perfectly rectangular, the corrugations parallel with the sides and regular in curve, pitch and depth, and the average weight of any ten sheets to be within 7.5% margin of the weights given in Para 10.1.1.3.

10.1.1.3. The weight of steel sheet before galvanizing shall be as given below:-

| | | |
|---|---|---|
| (1) | No.24 BG, weight of girthed surface | 4.924 Kg per Sqm. |
| (2) | No. 22 BG, weight of girthed surface | 6.247 Kg per Sqm. |
| (3) | No. 20 BG, weight of girthed surface | 7.809 Kg per Sqm. |
| (4) | No. 18 BG, weight of girthed surface | 9.760 Kg per Sqm. |
| (5) | No. 16 BG, weight of girthed surface | 12.490 Kg per Sqm. |

The allowance for increase in weight by galvanizing shall be 610 gm/ Sqm of girthed surface.

10.1.1.4. Galvanized steel sheets shall be thoroughly and evenly coated with Zinc, and be free of stains, bare spots and other defects.

10.1.1.5. When not galvanized, all sheets are coated immediately after manufacture with one coat of oil paint, applied by dipping or brushing over the whole of the surface of each sheet.

10.1.1.6. The corrugations are to be of standard pattern.

**10.1.2. Sloping Pattern Roofing.** The side edges of sheets shall be formed to a true curve. Rolls be 75 mm in dia and of the gauge, same as of sheeting.

**10.1.3. Plain Steel Sheeting.** Shall be of the quality, specified for corrugated steel sheeting.

**10.1.4. Single / Twin Wall Corrugated PVC Roof Sheet.** It is a superior product for residential, industrial, commercial, agricultural and educational projects. Typical design is shown at figure 10-1. It is exceptionally weather resistant and its technical specifications are given at Table 10-1:-

**TABLE 10-1**

| Specifications | PVC Single Wall Corrugated Sheets | PVC Twin Wall / Hollow Corrugated Sheets |
|---|---|---|
| Width (Effective) | 1000mm | 1000mm |
| Sectional Height | 34mm | 42mm |
| Standard Lenqth | 5.8m & 11.8m | 5.8m & 11.8m |
| Thickness | 2 to 3 mm | 11.10mm |
| Purlin Distance | 1.0 m | 1.2 m |
| Weight | ±4.2Kq/$m^2$ | ±5Kg/$m^2$ |
| Basic Material | UPVC with UV Protection Embedded | PVC with UV Protection Embedded |
| Standard Colors | Blue, White, Gray, Green & Red | Blue, White, Gray, Green & Red |
| Types | Opaque & Semi Transparent Sheets | Opaque & Semi Transparent Sheets |
| Coating | ASA with 10 years Color Fading & 25 years Structure Life Warranty | ASA with 10 years Color Fading & 25 years Structure Life Warranty |

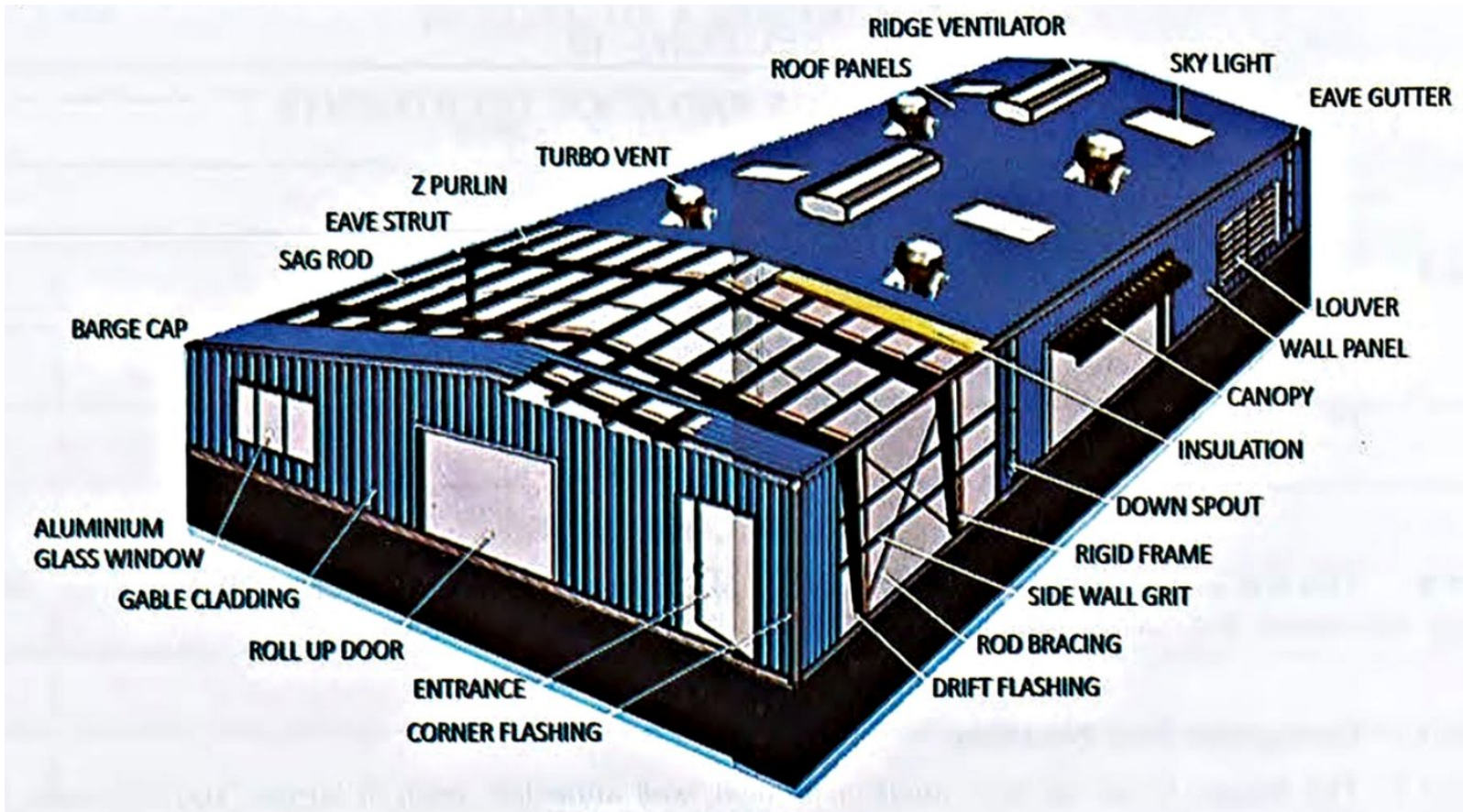



**FIGURE : 10-1**

## CONSTRUCTION REQUIREMENTS

**10.1.5. Corrugated Sheeting.** Sheet be fixed with galvanized screws or bolts, fiber and galvanized curved or limpet washers at a spacing not exceeding 300 mm centres in case of 8/3 corrugation sheets and at not exceeding 380 mm centres for 10/3 corrugation sheets on every bearer.

**10.1.6. Sloping Pattern Roofing**

10.1.6.1. Sheets shall be fixed with one screw at top center, three iron clips 75 mm x19 mm x 6 mm at each edge joint fixed with two screws 40 mm long and one center clip to bottom of sheet at eaves. Rolls shall be fixed with one screw at top. The sheet shall have an end lap of 150 mm.

10.1.6.2. Batman and Le Mesurier or other types of plain sheet roofing with roll side joints shall be similar to Sloping Pattern Roofing except for such modification as each type necessitates.

## METHOD OF MEASUREMENTS

**10.1.7. Measurements.** The net superficial area of sheeting, as fixed, is to be measured on the flat (not girthed corrugations) without any extra allow nce for laps or welts.

**10.1.8. Cutting.** Sheet cut to shape (as in stepped flashing) shall be measured overall, least dimension out of which the sheet can be cut.

**10.1.9. Openings.** No deductions shall be made for opening of any shape not exceeding 0.4 Sqm.

## CLARIFICATION OF RATES

**10.1.10.** The rates, inter alia, include particularly:-

(1) All screws, bolts and washers in any position.
(2) All cutting and waste
(3) Jointing to gutters and pipes.
(4) Labour in reducing to size, shape, figure, etc., and all straight, raking and circular cutting, waste, labour and materials in rolls, welts, seams, etc.

## SUB SECTION 10- 2

## WATER PROOFING TREATMENT

**10.2.0.** This sub-section consists of water proofing treatment i.e. felts, bui°lding paper, bitumen coating and membranes.

### MATERIAL REQUIREMENTS

**10.2.1. Bitumen Felt.** Shall be of specified thickness and type. Samples along with relevant literature will be submitted to the Engineer-in-Charge for obtaining approval, before the start of work at site.

10.2.1.1. **Primer.** It shall conform to ASTM D-41.

10.2.1.2. **Bitumen.** It shall conform to ASTM D-312 type-Ill, Bitumen Grade 10 / 20 PB 4.

**10.2.2. Building Paper.** Water proof building or insulating paper shall be of best quality with specified weight, stout, strong and thoroughly impregnated with water proof composition.

**10.2.3. Membranes.** Shall be of specified thickness and type. Samples along with relevant literature will be submitted to the Engineer-in-Charge for obtaining approval, before the start of work. Following types are generally available in the market with various brand names:-

10.2.3.1. **Bitumen Based Membrane.** Modified Bituminous Membrane is a torch bonding flexible waterproof sheet that consists of a very strong non - woven polyester reinforcement, coated on both sides with Modified Bitumen compound. The upper and lower surfaces are covered with Poly Ethylene film. It is also available in a variety of surface finishes for both covered and exposed applications. It is normally available in size of one meter (1M) wide sheet in 3mm and 4mm thickness. The jointing and bonding is done by using Propane gas torch. The material shall meet the requirements of ASTM D446, Heat resistant upto 130°C and have Tensile strength of 800 N / sq cm.

10.2.3.2. **Acrylic / Polymer / Synthetic Vinyl (PVC) Flexible Membrane.** It is composed of Synthetic Polymer Resins, plasticizers and pigments. It is synthetic Vinyl, a highly flexible and stable material, useful for application as a water barrier, where required. It can be jointed with different types of materials thermally / chemically. It is available in the form of sheets in thickness varying from 0.25mm to 2mm. Application and jointing shall be as per Manufacturer's instructions.

10.2.3.3. **Elastomeric Cementitious Water Proof Coating.** It is a cementitious mix of two components, a powder and a liquid. It is available in various sizes of packing. Once mixed, it forms an Elastomeric paste which can be sprayed or applied with a brush, keeping the ratio of mix accordingly. Once hardened, it requires mechanical means for removal.

10.2.3.4. **Admixtures / Construction Chemicals.** Various brands of admixtures are available in the market. These may only be used in accordance with the requirements specified in Para 3.6. The exact type and nomenclature will be decided by the designer and approved by the Engineer- in- Charge. However, some of the locally available types are highlighted below for reference only.

(1) **Latex** is a Carboxylated Spyrene Butadiene Copolymer. Latex admixture is designed as an integral adhesive for cement bond coats, mortar and concrete to improve bond strength and chemical resistance.

(2) **Superplast Super Plasticizer** is an advance organic polymer dispersant, used to modify Portland cement grout or concrete.

(3) **Water Proofing powder** is a balanced blend of sterate water repellant and other chemicals, which once used as admixture, forms an internal barrier against water penetration.

### CONSTRUCTION REQUIREMENTS

**10.2.4. General.** The work shall comply with the requirements of BS 8218 "Code of practice for Mastic Asphalt roofing" as applicable to the work. Waterproofing shall not be carried out when Ambient temperature is below $S^0C$ (40°F) *Of* before any pipes, drains etc. have been installed. The surface to receive water-proofing shall be prepared by filling up all pit holes and crevices with 1:3 cement-sand mortar and high spots shall be chipped off and ground smooth. The surface shall be thoroughly cleaned and shall be perfectly dry.

**10.2.5. Priming the Surface.** Over the prepared surface, specified primer shall be applied at the rate of 0.5 litre/ sqm.

**10.2.6. Sticking Coat of Bitumen / Felt Layers.** Over primed surface, indicated number of layers of roofing felt shall be installed.

10.2.6.1. Each layer of Felt shall be preceded by a sticking coat of bitumen @ 0.95Kg / Sqm. Bitumen shall be heated to flow freely but not above 162°C (325°F).

10.2.6.2. The Felt shall be laid with 101.6 mm end laps, free of wrinkles or air pockets underneath. While the sticking coat of bitumen is still hot, Felt will be pressed against the bitumen.

10.2.6.3. Laying of Felt layers shall be started from lower side of the roof. Felts shall be laid in shingle fashion, width overlapping along the length of felts shall be:-

(1) Side overlap = 50 mm

(2) End overlap = 150 mm

**10.2.7. Covering.** Coverings, as specified by the manufacturer will be provided.

**10.2.8. Storage.** Material should be stored vertically in a clean covered area. Rolls should not be stocked on top of each other.

**10.2.9. Health & Safety.** As with all bituminous products, caution should always be exercised. Protective clothing such as gloves and goggles should be worn. Treat any splashes to the skin or eyes with fresh water immediately. Should any of the products be accidentally swollen, don't induce vomiting, but call medical assistance immediately.

**10.2.10. Fixing Bitumen Based Membrane.** This torch bonding membrane will be fixed by applying heat with a Propane Gas torch. The manufacturer's Instructions will be followed to avoid defects and damage to the material.

**10.2.11. Admixtures/ Construction Chemicals.** Admixtures and other Chemicals which modify the properties of concrete shall be used on the advice of the designer and approval of the Engineer-in-Charge.

## METHOD OF MEASUREMENTS

**10.2.12. Measurement**

10.2.12.1. The work shall be measured net as laid.

10.2.12.2. Turn ups or turn downs at eaves, verges, abutments, etc. shall not be added to measurements.

10.2.12.3. Lengths and widths shall be measured to nearest cm.

**10.2.13. Deduction.** No deductions shall be made for:-

10.2.13.1. Cut out in portions in stepped flashing.

10.2.13.2. Opening not exceeding 0.4 Sqm.

**10.2.14. Additions.** No additions shall be made for:-

10.2.14.1. Portions turned into groves, joints of walls, etc.

10.2.14.2. Laps, joints, waste.

10.2.14.3. Linings to openings not exceeding 0.4 Sqm of openings.

## CLARIFICATIONS OF RATES

**10.2.15.** The rates inter alia, include particularly:-

(1) Work complete in all respects, as fixed in any position, or shape etc.

(2) 50mm side laps, 150mm end laps, open nailing, cuts, wastes, risk etc.

## SUB SECTION

## 10-3 ROOF

## INSULATION

**10.3.0.** Roof Insulation using brick tiles, PCC tiles, mud and Poly Extruded-Board / Sheet are covered in this section.

### MATERIAL REQUIREMENTS

**10.3.1. Brick Tiles**

10.3.1.1. Size of tile shall be

(1) 300 mm x 150 mm x 50 mm.

(2) 300 mm x 150 mm x 38 mm.

10.3.1.2. The plus or minus variation shall not exceed by 3.18 mm on width and length. Thickness shall not exceed(-) 2.38 mm.

10.3.1.3. The average breaking load applied along the width of the mid-way between the supports shall not be less than 79.40 Kg, when determined in standard manner.

10.3.1.4. Water absorption shall not exceed 10.5%.

10.3.1.5. Tiles shall be square at angles and of uniform shape .It will ring clear and true, when struck, and be approved, before incorporation in the work. These shall be bedded, if required, jointed and pointed on either lower or upper face in appropriate mortar.

**10.3.2. Cement Tiles.** These shall be pre-cast from the specified mix. The size shall be as specified. These shall be laid, jointed and pointed in the manner specified above.

**10.3.3. Tiles on Mud.** Mud shall be of stiff clay.

10.3.3.1. **Mud Mortar.** Clay for earth fill over, roofs, mud and tiles shall not contain more than 0.5% soluble salts, 0.2% sulphates or 4% organic contents. It shall not contain any gravel, coarse sand, kankar, roots of grass/ plants. Clay be obtained from good earth containing 20-30% Fine Sand.

10.3.3.2. **Layipg.** Apply to thickness ordered, and finish to levels, falls, dishings, etc. as required with 3 mm leaping.

10.3.3.3. **Slope of Mud Roofs.** Minimum 1 in 40 and Maximum 1 in 30.

### CONSTRUCTION REQUIREMENTS

**10.3.4.** The Construction requirements for Roof Insulation using brick tiles and PCC tiles are given in Figures 10-2 and 10-3 respectively:-

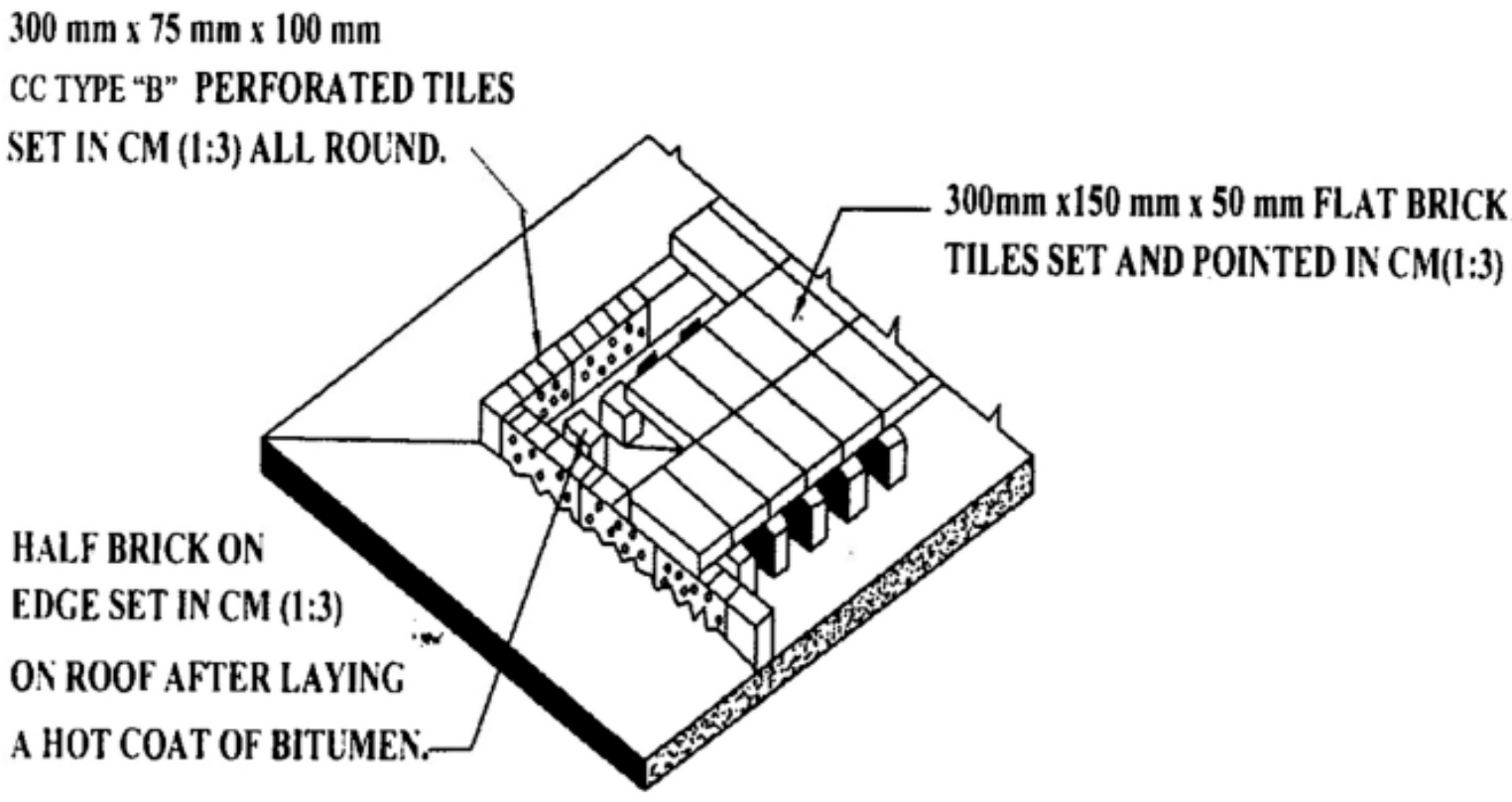

300 mm x 75 mm x 100 mm
CC TYPE "B" PERFORATED TILES
SET IN CM (1:3) ALL ROUND.
300mm x150 mm x 50 mm FLAT BRICK
TILES SET AND POINTED IN CM(1:3)
HALF BRICK ON
EDGE SET IN CM (1:3)
ON ROOF AFTER LAYING
A HOT COAT OF BITUMEN.

**FIGURE : 10-2**

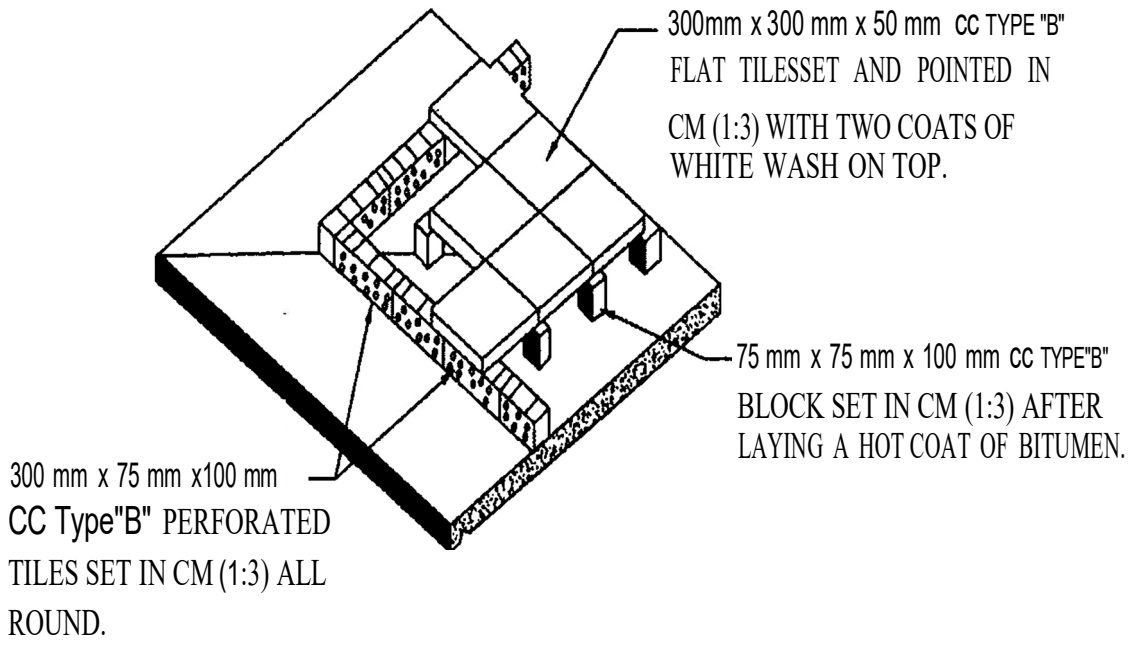

300mm x 300 mm x 50 mm CC TYPE "B"
FLAT TILESSET AND POINTED IN
CM (1:3) WITH TWO COATS OF
WHITE WASH ON TOP.
75 mm x 75 mm x 100 mm CC TYPE"B"
BLOCK SET IN CM (1:3) AFTER
LAYING A HOT COAT OF BITUMEN.
300 mm x 75 mm x100 mm
CC Type"B" PERFORATED
TILES SET IN CM (1:3) ALL
ROUND.

**FIGURE: 10-3**

## METHOD OF MEASUREMENTS

**10.3.5. Measurements.** Shall be net.

**10.3.6. Openings.** No deductions shall be made for opening of any shape not exceeding 0.4 Sqm each.

## CLARIFICATION OF RATES

**10.3.7.** The rates, inter alia include particularly:-

(1) Laying complete.

(2) Fillets on walls.

## ITEM RATES

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Sheets Roof (With End Laps)** | | |
| 10-1 | Supply and fix, **corrugated galvanized steel sheet 24 BG,** fixed to timber framing or a purlins, with one and half corrugation side laps and 150 mm end laps, fixed with screws, fibre and galvanized, curved or limpet washers at centre not exceeding 380 mm. | Sqm | 1495 |
| 10-2 | Same as item 10-1 but **22 BG,** all as specified. | Sqm | 1771 |
| 10-3 | Same as item 10-1 and 10-2, but except cost of sheets. | Sqm | 129 |
| | **Sheets Roof (Without End Laps)** | | |
| 10-4 | Supply and fix, **corrugated galvanized steel sheet 24 BG,** fixed to timber framing or purlins with one and half corrugation side laps and without end laps fixed with screws fibre and galvanized, curved or limpet washers at centre not exceeding 380mm. | Sqm | 1270 |
| 10-5 | Same as item 10-4 but **22 BG** all as specified. | Sqm | 1499 |
| 10-6 | Same as item 10-4 to 10-5 but except cost of sheets. | Sqm | 124 |
| | **Sheets with 'U' Bolts including End Laps** | | |
| 10-7 | Supply and fix **corrugated galvanized steel sheet 24 BG,** fixed to timber framing or purlins with one and half corrugation side laps and 150 mm end laps fixed with 'U' bolts 10 mm dia fibre and galvanized, curved or limpet washers at centres not exceeding 380 mm. | Sqm | 1621 |
| 10-8 | Same as item 10-7 but **22 BG** all as specified. | Sqm | 1897 |
| 10-9 | Same as item 10-7 to 10-8, but except cost of sheets. | Sqm | 255 |
| | **Sheets with 'U' Bolts Without End Laps** | | |
| 10-10 | Supply and fix, **corrugated galvanized steel sheet 24 BG,** fixed to timber/steel framing or purlins with one and half corrugation side laps and without end laps fixed with 'U' bolts 1O mm dia fibre and galvanized, curved or limpet washers at centres not exceeding 380 mm. | Sqm | 1396 |
| 10-11 | Same as item 10-10 but **22 BG,** all as specified. | Sqm | 1625 |
| 10-12 | Same as item 10-10 to 10-11, but except cost of sheets. | Sqm | 250 |
| | **Sheet with 'L' Hooks** | | |
| 10-13 | Supply and fix, **corrugated galvanized iron (CGI) sheet 20 BG,** fixed with 'L' hooks, limpet and bituminous washers end and side laps. | Sqm | 2104 |
| 10-14 | Same as item 10-13, but **22 BG.** | Sqm | 1851 |
| 10-15 | Same as item 10-13, but **24 BG.** | Sqm | 1576 |
| 10-16 | Same as item 10-13, 10-14 and 10-15, but fixing only. | Sqm | 209 |
| | **Aluminum Sheets** | | |
| 10-17 | Supply and fix, **Aluminum sheet, 20 BG,** with nails and screws, End and Side laps. | Sqm | 1689 |
| 10-18 | Supply and fix of **Aluminum corrugated sheets, 18BG** fixed with bolts/ screws etc., all as specified. | Sqm | 3077 |
| 10-19 | Same as item 10-17 and 10-18, but fixing only. | Sqm | 129 |
| 10-20 | Extra, for bolting, side laps, any gauge, at 225 mm centres. | Sqm | 203 |
| 10-21 | Extra, for bolting, end laps, each corrugation. | Sqm | 287 |
| | **Sloping Pattern Roofs** | | |
| 10-22 | Supply and fix, **corrugated galvanized steel sheet 24 BG,** fixed complete in all respects with nails, screws, clips etc., in Sloping pattern roofs, with rolled side joints, plain, 150mm end laps etc., including wooden battens, 40mm x 50mm for roll. | Sqm | 2272 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 10-23 | Same as item 10-22 but **22 BG,** all as specified. | Sqm | 2568 |
| 10-24 | Same as item 10-22 to 10-23, but except cost of sheets. | Sqm | 840 |
| 10-25 | Supply and fix, **corrugated galvanized steel sheet 24 BG,** fixed complete in all respects with nails, screws, clips etc., in Sloping pattern roofs, with rolled side joints, plain, without end laps, sheets, ridges, hips, valley, gutters etc. | Sqm | 2229 |
| 10-26 | Same as item 10-25 but **22 BG,** all as specified. | Sqm | 2524 |
| 10-27 | Same as item 10-25 to 10:.26, but except cost of sheets. | Sqm | 833 |
| | **Plain Galvanized Sheets** | | |
| 10-28 | Supply and fix, **Plain galvanized steel sheet 24 BG** in ridges, hips valleys and straight and stepped flashing roof plates and sleeve pieces etc., including wooden battens as required. | Sqm | 2269 |
| 10-29 | Same as item 10-28 but **22 BG,** all as specified. | Sqm | 2595 |
| 10-30 | Same as item 10-28 to 10-29 but except cost of sheets. | Sqm | 889 |
| 10-31 | Supply and fix, **Plain galvanized steel sheet 24 BG** in ridges hips, valleys and straight and stepped flashing, roof plates and sleeve pieces etc., without wooden battens as required. | Sqm | 1691 |
| 10-32 | Same as item 10-31 but **22 BG,** all as specified. | Sqm | 2017 |
| 10-33 | Same as item 10-31 to 10-32, but except cost of sheets. | Sqm | 311 |
| 10-34 | Supply and fix, **Plain galvanized steel sheet 20 BG,** in Gutters etc. with rounded edge any pattern, (fixed length girth not exceeding 450 mm wide) with support of galvanized , 19 mm x 6 mm strap, spaced not exceeding one meter apart, including angles outlet, stop ends etc. | Sqm | 2721 |
| 10-35 | Same as item 10-34, but **18 BG** all as specified. | Sqm | 3270 |
| 10-36 | Dismantling corrugated sheets for repair and re-fixing the same with screws. | Sqm | 110 |
| 10-37 | Same as item 10-36, but hook bolts or 'U' Bolts. | Sqm | 165 |
| | **Single Tile Roofs** | | |
| 10-38 | Providing and laying, **single layer of 300 mm x 150 mm x 50 mm Flat brick tiles** in roof, jointed and pointed in **CM 1:3.** | Sqm | 990 |
| 10-39 | Same as item 10-38, but size of **Flat brick tiles 300mm x 150mm x 38mm.** | Sqm | 882 |
| 10-40 | Supply and fix, **single layer of 300mm x 150mm x 50mm, PCC 3000 psi,** precast tiles on roof, jointed and pointed in **CM 1:3.** | Sqm | 1019 |
| | **Insulated Tile Roof** | | |
| 10-41 | Providing and laying, one layer of **300 mm x 150 mm x 50 mm Flat brick tiles** in roof, laid on half bricks on edge forming space in between, bedded, jointed and pointed in **CM 1:3** including 300 mm x 75 mm x 100 mm CC perforated tiles, set in CM 1:3 all round, including two coats of white washing on top, complete as shown in **Figure 10-1** (Coat of hot bitumen on the surface forming bed of half brick on the edge, to be paid separately, if ordered). | Sqm | 1437 |
| 10-42 | Same as item 10-41, but size of **flat brick tiles 300 mm x 150 mm x 38mm.** | Sqm | 1424 |
| 10-43 | Providing and laying, one layer of **300 mm x 300 mm x 50 mm, PCC 3000 psi, Precast tiles** on roof, laid on PCC 3000 psi precast blocks 75mm x 75mm x 100mm forming space in between, bedded, jointed and pointed in CM 1:3, and including 300 mm x 75 mm x 100 mm PCC perforated tiles set in CM 1:3 all round, two coats of white washing on top complete as shown in **Figure 10-2.** (Coat of hot bitumen on the surface forming bed of CC. Precast block, to be paid separately, if ordered). | Sqm | 1181 |
| | **Mud Roofs** | | |
| 10-44 | Providing and laying **Mud plaster 25mm thick and leaping over 50mm thick mud on roofs.** | Sqm | 278 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 10-45 | Same as item 10-44 but over **75 mm thick mud on roofs.** | Sqm | 300 |
| 10-46 | Same as item 10-44 but over **125 mm thick mud on roofs.** | Sqm | 343 |
| 10-47 | Providing and laying **Mud plaster 25 mm thick including 3 mm leaping** on roof or floor. | Sqm | 235 |
| 10-48 | Providing and laying **3 mm thick leaping** on roof or floor. | Sqm | 102 |
| | **Felt Work** | | |
| 10-49 | Supply and fix, **two ply bituminous Felt,** in flashing and concrete / brick work joint, joint wedged and tucked inside end joints, stuck with approved bituminous adhesive. | Sqm | 477 |
| | **Building Paper** | | |
| 10-50 | Supply of **water proofing building or insulating paper,** weighing 3.92 Kg per 10 sqm, and fix in any position with 50 mm side and 150 mm end laps and nailing, as described for Felt. | Sqm | 153 |
| | **Bitumen Coating** | | |
| 10-51 | One coat of bitumen, applied hot on roof@ 0.75 Kg/sqm and blinded with sand, at 0.012 cum per sqm (including cleaning surface). | Sqm | 172 |
| 10-52 | One coat of water proofing compound, using Bitumen 10/20, applied hot @ 4.90 Kg /10sqm. | Sqm | 150 |
| 10-53 | Same as 10-52, but@ 14.68kg /10sqm. | Sqm | 296 |
| 10-54 | One coat of bitumen 10/20, @ 1.46 kg per sqm, blinded with sand @ 0.012 cum per sqm. | Sqm | 335 |
| 10-55 | Same as item 10-54, but@ 2.44 kg/sqm. | Sqm | 442 |
| 10-56 | One coat of water proofing primer, cold sticker, (Bituminous Emulsion) @ 0.75 Kg/sqm all as specified. | Sqm | 122 |
| | **Water Proofing Treatments** | | |
| 10-57 | Supply and laying, **one layer of Polyester Based Roofing Bitumen Felt,** weighing 16 Kg to 18 Kg /10 Sqm with side lap, end laps including water proofing bitumen primer 0.50 lit /Sqm including bitumen sticking coat 10/20 @ 0.95 Kg/Sqm, bitumen paint coat @ 0.95 Kg/Sqm over bitumen felt, blinded with 3 mm aggregate@ 0.012 Cum /Sqm, complete all as specified. | Sqm | 653 |
| 10-58 | Same as item 10-57, but in **double layer.** | Sqm | 1033 |
| 10-59 | Two coats of **Elastomeric Cementitious Water Proofing** Coating, applied as per manufacturer's instructions, all as specified. | Sqm | 949 |
| 10-60 | Providing and laying, **3mm thick Torch Bonding Bituminous Membrane [Poly Propylene (PP) / Poly granular (PG)]** with self-adhesive side lap 75mm, end lap 100 mm, complete as specified. | Sqm | 1118 |
| 10-61 | Same as item 10-60, but **4 mm thick.** | Sqm | 1402 |
| 10-62 | Supply and fix, **Synthetic Vinyl (PVC) Flexible Membrane, 0.25 mm thick** with 75-100 mm side laps / end laps, seamed/ welded thermally /chemically, all as per manufacturer's specification. | Sqm | 258 |
| 10-63 | Sam as item 10-62, but **0.50 mm thick.** | Sqm | 516 |
| 10-64 | Same as item 10-62, but **1 mm thick.** | Sqm | 1045 |
| 10-65 | Same as item 10-62, but **2 mm thick.** | Sqm | 1821 |
| 10-66 | Supply and fix, **Poly Extruded board** 50 mm thick density 32-35 Kg /m3, fixed on as roof insulation with ship lap edges having any size. of sheet, all as specified. | Sqm | 1024 |
| 10-67 | Providing and laying water proofing textile **Geomembrane 0.25 mm thick.** | Sqm | 829 |
| 10-68 , | Providing and laying **Crystalline water proofing chemical coating** on concrete surface at rate of 1 kg/$m^2$ as per manufacturer specification, described in para 3.6.4 of $action 3 . | Sqm | 192 |

| Sl No. | Description | Unit | Rate (Rs) j |
|---|---|---|---|
| 10-69 | Providing and laying **Acrylic based rubberized liquid membrane,** all as per manufacturer's specifications. | Sqm | 893 |
| | **PVC Sheet Roofing** | | |
| 10-70 | Supply and fix PVC 5 C twin hollow or single hollow corrugated sheet/ roofing coated weighing not less than 5.38 Kg/Sqm except framing all as specified. | Sqm | 3064 |
| 10-71 | Supply and fix PVC 5 C twin hollow or single hollow corrugated sheet/ roofing translucent weighing not less than 4.t:342 Kg/Sqm except framing all as specified. | Sqm | 4807 |
| 10-72 | Supply and fix PVC top ridge, hips/ valley and flashing plates etc. complete except framing all as specified. | Sqm | 3013 |
| 10-73 | Supply and fix PVC plain sheet/ roofing embedded (2 mm thick) complete except framing all as specified. | Sqm | 2470 |

# RECORD OF AMENDMENTS

| SINO | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION -11

# TERMITE TREATMENT

## SPECIFICATIONS

**11.0.** This section covers termite treatment of old & new buildings and joinery works.

### MATERIAL REQUIREMENTS

**11.1. Termite Treatment.** The chemicals approved by Pakistan Council of Scientific and Industrial Research (PCSIR) shall be used with approval of Engineer-in-Charge.

### CONSTRUCTION REQUIREMENTS

**11.2. New Buildings (Pre-Construction Treatment)**

11.2.1. Treatment of beds and sides of excavated foundation trenches.

11.2.2. Treatment of back fills.

11.2.3. Treatment of filled up earth.

11.2.4. Treatment of surrounding areas within 5M of the building.

11.2.5. Any other operation, which the specialized firm may consider necessary in context to their guarantee obligations. Minimum acceptable rate of application of termite solution is as per manufacturer's specifications (Normally 1 Litre of Chemical shall be mixed in 50 Litres of water). Both, contractor and firm will submit warranty of minimum 5 years from the date of completion of the work.

**11.3. Old buildings (Post-Construction Treatment)**

11.3.1. Provision of Exterior Chemical barrier around the plinth protection by drilling 13mm diameter holes to a depth of 600-900 mm at intervals of 1200-1500 mm and by filling these holes with approved Termite Proofing chemical in required quantity, having dilution as recommended by the manufacturer of chemical and sealing with chemical paste.

11.3.2. Provision of Interior Chemical barrier as Para 11.3.1 above, but drilling 6-13 mm dia holes and sealing with cement / chemical paste.

11.3.3. Barrier on either side of interior walls of the building as Para 11.3.2 above.

11.3.4. Any other additional operation, which the specialized firm may consider necessary, in context to their guarantee obligations.

**11.4. Wooden Joinery.** Wooden Joinery means Doors, windows, CSWs, wooden partition, floors, ceilings cupboards, kitchen cabinet, door chowkat and architrave, frames of joinery, cupboards, ends of trusses / framings in ceiling etc. or any other wooden item etc. Termite proofing to new and old joinery as defined above, is for unit area (length and breadth} covering following operations.

11.4.1. **New Joinery.** Treatment of joinery with Termite chemicals suitable for wood preservation with brush coating or spraying, as approved by the Engineer-in-Charge.

11.4.2. **Old Joinery.** Treatment of old joinery by drilling holes 13 mm diameter at the side / back, at intervals of 300 - 450 mm around the same. These holes and any cracks found along the chowkats, frames, embedded ends of frames etc., are filled with approved Termite Chemical and plugged with cement/ chemical paste as considered necessary by the specialized firm in context to their guarantee obligations.

### METHOD OF MEASUREMENTS

**11.5.** For new or old building, plinth area shall be measured along the outer side of walls at DPC level.

**11.6.** Wooden joinery, partition and ceilings etc., shall be measured on one side only. Wooden trusses and beams etc., shall be measured (length x girth) of the item.

### CLARIFICATION OF RATES

**11.7.** The rates will be paid for one storey i.e. only for basement or Ground Floor.

**11.8.** For wooden joinery, partition and ceilings etc, rates are applicable to all floors

## ITEM RATES

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 11-1 | **Termite proofing of New buildings** with approved chemicals except joinery. | Sqm | 248 |
| 11-2 | **Termite proofing of Old buildings** with approved chemicals except joinery. | Sqm | 223 |
| 11-3 | **Termite proofing of old wooden joinery,** with approved chemical. | Sqm | 101 |

# SECTION-12

# **FLOORING AND** TILING

,

## RECORD OF AMENDEMNTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| 11 | | |
| | | |
| | | |
|

# SECTION-12

# FLOORING AND TILING

## SPECIFICATIONS

**12.0.** This section covers flooring of concrete, terrazzo, glazed tiles, marble, granite, aluminium composite panel (wall cladding), wooden flooring and pavers.

## MATERIAL REQUIREMENTS

**12. 1. Cement.** Shall be Ordinary as specified in Section 3.3.1 (Type-I), Normal Setting Cement of any brand, unless, otherwise, specified to be of any particular quality.

**12.2. Hardcore.** It shall be well graded hard crushed / broken aggregates, free from dust etc. not exceeding 63 mm. Any of the material, specified for aggregates may be used.

**12.3.** Provide sand filling under floor conforming to ASTM C33/C33M or as specified. The sand shall be from approved source and free from dust and salt. For additional explanation, refer to para 4.5, section-4.

**12.4. Terrazzo**

12.4.1. **Marble Chips.** It shall be crushed marble of best quality, white or coloured, must have an abrasive hardness of not less than 10 when tested in accordance with ASTM C241/C241M, contain no deleterious or foreign matter and less than 1% dust content (passing Sieve No. 200 by weight) The size shall vary from No. 4 to No 8 or as specified.

12.4.2. **Dividing Strips.** Shall be marble / aluminum / brass having thickness and width as specified.

**12.5. Terrazzo (Mosaic) Tiles.** The tiles shall adhere to the specifications given below and approved by the Engineer-in-Charge. These will be hydraulically compressed at 140 Kg / Sq cm. Normal size and thickness of the tiles shall be as follows:-

(1) **200 mm x 200 mm x 20 mm of White or Ordinary cement,** with coloured or white marble chips of ratio 2 parts of cement and 3 parts of marble chips (max size 10 mm) with 10mm thick topping on 10mm thick base of CM 1:2.

(2) **300 mm x 300 mm x 25 mm of White or Ordinary cement,** with coloured or white marble chips of ratio 2 parts of cement and 3 parts of marble chips (max size 13 mm) with 13mm thick topping on 12mm thick base of CM 1:2.

**12.6. Glazed / Ceramic / Porcelain Tiles.** The glazed / matt/ Ceramic/ Porcelain tiles have been categorised in three categories i.e. **Standard, Deluxe and Premium depending upon size** and will be approved by the Engineer-in-Charge.

12.6.1. **Floor Tiles Full Body.** Shall have hard and tough material of full thickness of the tile.

12.6.2. **Floor/ Wall Glazed tile.** Shall have 1mm thick glazing on top of the tile.

**12.7. PVC Tiles.** Shall be of specified thickness and type, locally manufactured. Samples will be submitted to the Engineer-in-Charge for obtaining approval before the start of work.

**12.8. Artificial Stone Face Tiles.** These are artificial stone face tiles, prepared by incorporating cement, reclaimed stone and pigments etc. The face is treated with specially prepared hardener in order to produce a strong, durable and weather resisting product. It is moulded in vibrating compaction moulds for the desired density. The appearance is matt and of different sizes. The thickness of these tiles varies from 13-25 mm. The quality shall be approved by the Engineer-in-Charge, before incorporation.

**12.9. Marble Tiles.** Marble shall be compact, dense, metamorphic rock of lime stone origin, from quarries in Pakistan. It shall have Specific Gravity of about 2.7 and density of 2723.14 Kg / Cum (170 lbs / Cuft). It must be evenly grained with sugar-like appearance, when broken. The type of marble has been specified as **Standard, Deluxe, and Premium based on size and thickness** and shall be approved by Engineer-in-Charge.

**12.10. Granite Tiles.** Granite shall be of approved quality, colour and grain. The type of granite tile shall be specified as **Standard, Deluxe, and Premium** based on thickness and will be' as approved by the Engineer-in- Charge.

**12.11. Aluminium Composite Panel (Wall Cladding).** It shall be used for interior and exterior building cladding and signage. It shall be of specified thickness and type, local or imported. Manufacturer's samples along with relevant brochure will be submitted to the Engineer-in-Charge for obtaining approval, before the start of work. It will consist of the following:-

(1) **Top layer.** Aluminium coated with choice of PVDF or Polyester

(2) **Core.** Non-toxic material of the choice of Polyethylene or fire retardant minerals.

(3) **Bottom layer.** Aluminium in mill finish or coated with primer paint. '

**12.12. Wooden Flooring.** Shall consists of artificial wooden/ laminated tiles as per manufacturers specifications.

**12.13. Paving Stones**

12.13.1. **Strength.** It shall have **Minimum 28 days Cylinder Compressive strength:-**

(1) 35 MPa (5000 psi) for 50 mm thickness.

(2) 48 MPa (7000 psi) for 60 / 80 mm thickness.

12.13.2. **Thickness of Sub Base and pavers.** Recommended thickness of sub base and pavers is shown in Table 12-1:-

**TABLE 12-1**

| Application | Thickness of sub-base mm (in.) | | Thickness of paver (mm) |
|---|---|---|---|
| | Dry Area | Low Wet Area | |
| **LIGHT DUTY** Residential, drive way, walk ways, parking patios etc. | 0 to 76 (0 to 3) | 100 to 204 (4 to 8) | 50 |
| **MEDIUM DUTY** Residential, Streets, Public Parking, service road, maintenance area, canal lining, storage area, City petrol pumps etc. | 100 to 152 (4 to 6) | 254 (10) | 60 |
| **HEAVY DUTY** City Streets, Loading deck, Industrial floors, Highway petrol pumps etc. | 204 (8) | 305 (12) | 80 |

12.13.3. **Shapes** and details of different pavers are shown in the typical sketches given in Figure 12-1.

12.13.4. **Quantity and thickness** required per Sqm of different shape and size is shown in Table 12-2:-

**TABLE 12-2**

**Specification for the Paving Stone**

| S.No. | Type | Thickness (mm) | Area per Tlie Sq cm (Sq In.) | Nos. of Tiles/Sqm (Tiles/Sq Ft) |
|---|---|---|---|---|
| 1. | **Uni-Block** | 50/60/80 | 249.74 (38.71) | 39.81 (3.70) |
| 2. | **I-Section** | 50/60 | 270.83 (41.98) | 36.90 (3.43) |
| 3. | **Rectangle** | 60/80 | 196.90 (30.52) | 50.67 (4.71) |
| 4. | **Half Rectangle** | 60 | 128.12 (19.86) | 78.01 (7.25) |
| 5. | **Wavy** | 60 | 275.99 (42.78) | 35.83 (3.33) |
| 6. | **Hexagon** | 60 | 346.64 (53.73) | 28.83 (2.68) |
| 7. | **Delta** | 50 | 245.74 (38.09) | 40.67 (3.78) |
| 8. | **Square** | 50 | 929.03(144.00) | 10.76 (1.00) |

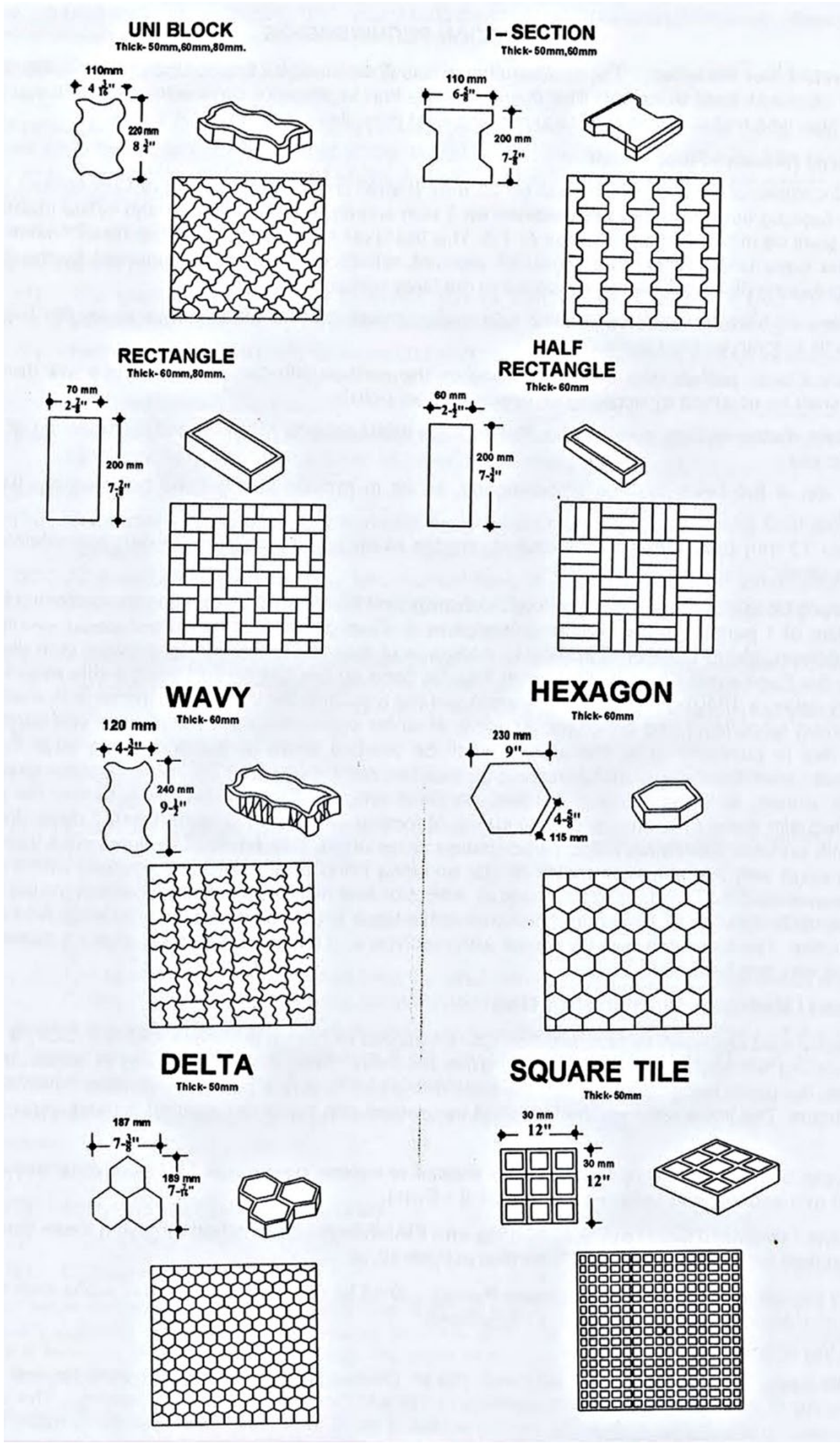



FIGURE : 12-1
SKETCHES OF VARIOUS COMMON **PAVING** STONES
SHOWING SHAPES AND DIMENSIONS

## CONSTRUCTION REQUIREMENTS

**12.14. Concrete Floor Finishes.** The surface of concrete floors shall be finished fair, smooth with neat cement @ 0.06 bag / sqm and steel trowelled The floors shall be laid in alternate bays with wrought wood parting slip (expansion joints), which shall be left in, if required. Pre-cast floor slabs shall have fair edges.

**12.15. Terrazzo (Mosaic) Floor Finish**

12.15.1. The thickness of terrazzo finish shall be 20 mm. It shall consists of one part of Cement and two parts of marble chips, passing through 5 mm and retained on 2 mm screen. If both Coloured and White marble chips are ordered, they shall be mixed in the proportion of 1:3. This top layer of terrazzo finish shall be laid within 30 minutes after laying the base under layer. The colour of pigment, where used, shall be approved by the Engineer-in- Charge. The colouring pigments will not be added to the Grey cement.

12.15.2. Surface of terrazzo shall be rubbed with carborundum blocks, after 3 days of laying, beginning with coarser grade till smooth surface is obtained.

12.15.3. Finally, Oxalic acid powder shall be rubbed on the surface with pieces of felt and a few drops of water. Glossy finish shall be obtained by applying an approved floor polish.

12.15.4. In walls, dados, skirting and the like, the terrazzo finish shall be given a base by rendering of CM (1:3) of specified thickness.

12.15.5. The top of the base shall be crosshatched, so as to provide strong bond between the base and the terrazzo finish.

12.15.6. When 13 mm thick terrazzo is specified, marble chips passing through 10 mm and retained on 3 mm screen will be used.

**12.16. Terrazzo (Mosaic) Floor Tiles (Laying/ Jointing and Finishing).** A padding or cushioning layer 25 mm thick, consisting of 1 part of freshly cement and 3 parts of clean coarse sand shall be spread evenly and to the required slope/level, giving due consideration to thickness of tiles to ensure correct finished floor slope/level, as instructed by the Engineer-in-Charge. Tiles shall then be fixed on the CM by spreading a thin even layer of neat Cement slurry (using 4.1O Kg cement per Sqm area) and the tiles shall be worked into mortar with a wooden mallet to ensure correct slope/level and adhesion. All joints shall be approximately 1.5 mm wide and parallel to walls. After laying tiles in particular area, the surface shall be washed down at the end of the days work and any unevenness removed. No traffic shall be allowed on tiles laid for 3 days. After 24 hours, the tiles shall be grouted with coloured cement, as in the matrix of the tiles, ensuring filling of all joints. The top surface of the joint shall be lightly sprinkled with water to ensure adequate curing of jointing cement. After a minimum 7 days, the floors shall be ground with portable machines, using carborundum stone of grit size 60-80. The floors shall then be washed down and grouted with cement as in matrix of tile, ensuring filling of all joints and cavities, which may appear. Grouting material shall be cured, as stated above. Just prior to polishing, the floors shall be ground down, using fine grit carborundum stone i.e. 200 or finer, washed with a weak acid such as Tartaric or Oxalic Acid to remove all surface impurities. The tiles shall then be waxed with machine to a full gloss. No traffic shall be allowed on waxed floors until the wax has hardened.

**12.17. Glazed/ MaW ceramic/ Porcelain Tiles**

12.17.1. Glazed/ matt tiles shall be laid /fixed on CM 1:4 screed of 13 mm thickness. Old wall shall be well watered and the screeding left slightly rough (by being cross hatched). Tiles, first well soaked in water, are bedded in cement paste, the paste being "buttered" on the back of the tiles to give a bed of 6 mm, after which tile is pressed and tapped home. The joints between the tiles shall be grouted with White or Coloured cement, according to colour
of tiles.

12.17.2. In case of split tiles, these should not be soaked or wetted, before use. Minimum thickness of mortar bed should be 1O mm and the joint between the tiles be 3 - 5 mm.

**12.18. Marble/ Granite Tiles (Laying/ Jointing and Finishing).** The method for laying these tiles shall be the same as specified for Terrazzo (Mosaic) Floor tiles in Para 12.16.

**12.19. Wall Cladding (Aluminum Composite Panel).** Shall be provided by aluminum crafts-men on wooden or aluminum frame work as per manufacturer's instructions.

**12.20. Paving Stones**

12.20.1. **Sub-Base.** The sub-base for approach roads, driveways and parking lots used for low speed traffic, should comprise of minimum thickness as specified in Table12-1or as mentioned in drawings. The sub-base may have been used by site traffic, before the paving is laid. It must, therefore, be inspected to make sure that it is structurally sound, free of debris or mud etc. and its surface level is correct. Any faults must be rectified, before laying course is spread.

12.20.2. **Laying Course.** The Laying course, about 50 mm thick after vibration, consists of clean, washed, sharp sand, containing not more than 3% of Silt and Clay by weight. To achieve the best regularity in the finished surface, the sand should be uniform in type and moisture content, spread to a smooth level, without uneven

compaction. To help maintain uniformity, the sand should be obtained from a single source, allowed to dry before use and sheeted over to minimize changes in moisture content.

12.20.3. **Screeding to Level.** Screeding is done by traditional methods. For roads upto 5 M wide, it can be done from the kerbs and for wider roads or over large areas, temporary screed rails set to level be used.

12.20.4. **Surcharge.** After final vibration, the Inter-lock pavers will be lower than their initial level, because, the laying course sand has been compacted and some moved up into the joints between the blocks. Thus, the sand has to be laid to a surcharge, the amount of which depends on the type and moisture content of the sand, but is normally in the range 5-15 mm.

12.20.5. **Surface Course**

12.20.5.1. **Placing the First Pavers**

(1) The positioning of the first Inter-lock pavers demand extra care. To give the required laying pattern, the pavers must be placed at the correct angle against a firm starting edge.

(2) Each inter-lock paver has to be placed very carefully, so as not to disturb its neighbours, and it is not disturbed, until three or four rows have been placed so that normal rapid laying rates can be achieved.

(3) The order of laying must ensure that the pavers can be placed easily and in such a way that it is never necessary to force a paver between those already laid.

12.20.5.2 **Laying**

(1) Each inter-lock paver must be placed firmly against its neighbours, being held slightly above the laying course, so as not to disturb sand until paver is in its correct place.

(2) All inter-lock pavers must be laid, so that they fit closely together. If joints begin to open, the pavers should be knocked together with a wooden hammer. Care must be taken not to tilt pavers on the leading edge of the laying face, by standing or kneeling on them.

(3) Paver laying is continued until enough area has been laid, to make vibration worthwhile, say 15-20 Sqm. Men or light equipment can move over the pavers before, they have been vibrated. At this stage, an uneven surface may be faced, but, this will be ironed out by the plate vibrator.

12.20.5.3. **Edging**

(1) Where inter-lock pavers do not fit at the edges, the spaces are filled with cut pieces, but, very small pieces are best chipped off with a bolster and hammer.

(2) Where the gaps are small, e.g. less than 50 mm, they can be filled with 1:4 cement sand mortar.

12.20.5.4. **Vibration**

(1) The inter-lock pavers are vibrated to their final level with plate vibrator, having a plate 0.2-0.3 Sqm and a centrifugal force of approximately 1 Ton is suitable. There is no advantage in using a heavy machine.

(2) The vibration should be guided over the whole area, avoiding any un-restrained edge by about a meter. Two or three passes are normally needed to vibrate finished level.

12.20.5.5. **Filling the joints.** After the initial vibration, sand is brushed over the surface of the pavers and is vibrated into the joints by further two or three passes of the plate vibrator. After all the joints are filled, surplus sand can be swept away. The paved area is now ready for use.

**12.21. Screed Bed on Bond Breaking Layer** (Refer to TI - 52-F)

12.21.1. Contents

| | | |
|---|---|---|
| (1) | Port land Cement | = 50 Kg (one bag) |
| (2) | Acetylene black (Calcium Carbide) | = 0.80 Kg |
| (3) | Coarse sand | = 0.06 Cum |
| (4) | Screening 13 mm | = 0.09 Cum |

12.21.2. The water contents are kept sufficiently low to affect a slump of less than 25 mm. The sand, Acetylene black (Calcium Carbide) and Cement are mixed together first and then water is added, before the coarse aggregate. If a revolving drum type mixer is used, the order of mixing may have to be altered to prevent balling of mix. Mixing should be continued for 2-3 minutes.

**12.22. Sodium Silicate Application**

12.22.1. Three coats of Sodium Silicate will be provided as approved by the Engineer-in-Charge.

12.22.2. The first application shall consist of 1 part of Sodium Silicate to 5 parts of clean water and the second and third coat shall consist of 1 part of Sodium Silicate to 6 parts of clean water. The first application shall be given over

the surface after 1O days of laying the concrete. The second and third application shall be given after first and second have dried. Uniform application shall be ensured by using broom and a can fitted with rose.

## METHOD OF MEASUREMENTS

**12.23. Measurements.** All work be measured net and flat (not girthed). For tiles and floors, architectural dimensions be taken ignoring thickness of finishes.

**12.24. Openings.** No deduction or additions shall be made for opening not exceeding 0.4 Sqm.

## CLARIFICATION OF RATES

**12.25.** The rates, inter alia, include particularly:-

(1) Rendering, forming base of tiles is to be paid separately at the relevant rates.

(2) Thickness of hard core will be of the finished work after ramming and not the thickness as spread.

(3) Channel formed in concrete floors, when over 40 Sqcm in section, the curved water way shall be deducted as¾ x width (max dimension).

(4) Cement shall not be issued under Schedule 'B' for pre-cast/ manufactured items i.e mosaic tiles, paving stones etc.

(5) Slope allowance and breakages of tiles.

(6) Where Sulphate Resistant Cement is ordered and used, it shall be Sulphate Resistant Portland Cement of the approved make fully conforming to ASTM C - 150 / BSS 4027. Th relevant rate for payment shall be increased by the ratio of increase in the rates of Sulphate Resistant Cement over Ordinary Portland Cement only.

**ITEM RATES**

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Sub Floors** | | |
| 12-1 | Providing and laying **PCC 1:4:8,** laid under floor using crushed or broken stones. | Cum | 6482 |
| 12-2 | Same as item 21-1 but **PCC 1:6:12,** all as specified. | Cum | 5845 |
| 12-3 | Same as item 21-1 but **PCC 1:3:6,** all as specified. | Cum | 7107 |
| | **Floors** | | |
| 12-4 | Providing and laying **burnt bricks, laid flat,** in floors, roofs and channels etc. laid, jointed in **sand or mud.** | Sqm | 738 |
| 12-5 | Same as item 12-4 but, **laid on edge,** all as specified. | Sqm | 1067 |
| 12-6 | Providing and laying **burnt bricks, laid flat,** in floors, roofs and channels etc., laid, jointed and pointed in **CM 1:4.** | Sqm | 971 |
| 12-7 | Same as item 12-6 but, **laid on edge,** all as specified. | Sqm | 1393 |
| 12-8 | Providing and laying **burnt bricks·,laid flat,** in floors, roofs and channels, etc. laid, jointed and pointed in **CM 1:6.** | Sqm | 935 |
| 12-9 | Same as item 12-8 but, **laid on edg .** all as specified. | Sqm | 1360 |
| 12-10 | Providing and laying, **PCC 1:3:6,** as in floor, slabs, surface finished smooth with neat cement and steel trowel, using crushed or broken stone for Basement /ground floor. | Cum | 7013 |
| 12-11 | Same as item 12-10 but **PCC 1:2:4,** all as sp cified. | Cum | 8139 |
| 12-12 | Providing and laying, **PCC 1:3:6** laid in floor, slabs as under layer for Terrazzo / tiles top finished, using crushed or broken stone. (for GF,1st,2nd floor and lower ground /basement 1st, 2nd, 3rd). | Cum | 6225 |
| 12-13 | Same as item 12-12 but, **PCC 1:2:4,** all as specified. | Cum | 7353 |
| | **Additional Labour Cost** | | |
| 12-14 | Add to item 12-10, 12-11, 12-12 and 12-13 labour only for each storey above 2nd floor. | Cum | 39 |
| | **Paving Stones** | | |
| 12-15 | Providing and laying, **PCC Paving stone, 50 mm thick in natural colour,** as in floors, drive-way, walk-way etc., any pattern and any shape, (Hydraulically compressed), laid and jointed in sand, including 50mm thick sand bed as laying course, all as specified. | Sqm | 861 |
| 12-16 | Same as item 12-15 but, **PCC Paving stone, 50 m·m thick in any colour (except natural colour),** all as specified. | Sqm | 896 |
| 12-17 | Providing and laying, **PCC Paving stone, 60 mm thick in natural colour,** as in floors, streets, public parking etc., any pattern and shape, (Hydraulically compressed), laid and jointed in sand, including 50 mm thick sand bed as laying course, all as specified. | Sqm | 912 |
| 12-18 | Same as item 12-17 but, **PCC Paving stone, 60 mm thick in in any colour (except natural colour),** all as specified. | Sqm | 940 |
| 12-19 | Providing and laying, **PCC Paving stone 80 mm thick, in natural colour,** as in floors loading decks, highway petrol pumps etc., any pattern and shape, (Hydraulically compressed), laid and jointed in sand, including 50mm thick sand bed as laying course, all as specified. | Sqm | 1120 |
| 12-20 | Same as item 12-19 but, **PCC Paving stone 80 mm thick, in any colour (except natural colour),** all as specified. | Sqm | 1165 |
| | **Dividing Strips In Floor** | | |
| 12-21 | Supply and fix, 2 mm **thick and 40 mm wide aluminium, as dividing strips,** in floors. | Metre | 111 |
| 12-22 | Same as 12-21 but **25 mm wide dividing strips.** | Metre | 110 |
| 12-23 | Supply and fix, **8-10 mm thick and 40 mm wide marble patty, as dividing strips** in floors. | Metre | 92 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Terrazzo Floors** | | |
| 12-24 | Providing and laying, **20 mm thick Terrazzo floor** using marble chips (1:2) with **ordinary cement,** including cutting and rubbing (except polishing) (for Basement, GF, FF and 2nd floor ) | Sqm | 884 |
| 12-25 | Same as item 12-24 but with **White/ Coloured cement.** | Sqm | 1350 |
| 12-26 | Providing and laying, **13 mm thick terrazzo floor,** using marble chips (1:2) with **ordinary Cement** including cutting and rubbing, (except polishing). (for GF, 1st, 2nd floor and lower ground /basement 1st, 2nd, 3rd). | Sqm | 750 |
| 12-27 | Same as item 12-26 but with **White/ Coloured cement.** | Sqm | 1053 |
| 12-28 | Providing and laying, **13 mm thick dados, skirting** , using marble chips (1:2) with **ordinary Cement** including cutting and rubbing, including 10mm thick Cement plaster (1:3), (except polishing). (for GF,1st,2nd floor and lower ground /basement 1st, 2nd, 3rd). | Sqm | 825 |
| 12-29 | Same as item 12-28 but with **White/ Coloured cement.** | Sqm | 1115 |
| 12-30 | Add to item12-24 to 12-29 for labor only above 2nd floor. | Sqm | 120 |
| 12-31 | Grinding / rubbing of Terrazzo floor /dado. | Sqm | 152 |
| 12-32 | Cleaning and **wax polishing** of Terrazo floor/ dado. | Sqm | 77 |
| 12-33 | Cleaning and **chemical polishihg** of terrazzo floor/ dado/Marble floors. | Sqm | 168 |
| 12-34 | Providing and laying of **sand cushion** under floor. | Cum | 1352 |
| | **Tile Work** | | |
| 12-35 | Providing and laying **Standard quality** tiles of any make **not exceeding 1600 Sq cm,** including setting, jointing and bonding, complete all as specified. | Sqm | 3197 |
| 12-36 | Same as item 12-35 but **Deluxe quality tiles of any make, size exceeding 1600 sq cm but not exceeding 3700 sq cm.** | Sqm | 3975 |
| 12-37 | Same as item 12-35 but **Premium quality tiles of any make, size exceeding 3700 sq cm.** | Sqm | 4378 |
| 12-38 | Providing and laying **Standard quality marble tiles** (Sunny grey, Badel, Ziarat grey, Sunny white, zebra, Taveera boticina, Supreme white, Parlino stain boticina, Flower boticina), of any size, **13 mm thick** including setting, jointing , bonding and chemical polishing, complete all as specified. | Sqm | 1451 |
| 12-39 | Same as item 12- 38 but **20 mm thick.** | Sqm | 3531 |
| 12-40 | Providing and laying **Deluxe quality marble tiles** (Fancy Royal boticina, Parlino crystal boticina, Ziarat water shade, Parlino plane boticina, Parlino micro boticina,Ziarat white), of any size, **13 mm thick** including setting, jointing, bonding and chemical polishing, complete all as specified | Sqm | 2189 |
| 12-41 | Same as item 12-40 but **20 mm thick.** | Sqm | 6623 |
| 12-42 | Providing and laying **Premium quality marble tiles** (Ziarat supreme white), of any size, **13 mm thick** including setting, jointing, bonding and chemical polishing, complete all as specified. | Sqm | 6712 |
| 12-43 | Same as item 12-42 but **20 mm thick.** | Sqm | 15434 |
| 12-44 | Providing and laying **Standard quality granite tiles** (Indus gold, Tropical), of any slze, **20 mtn thick** including setting, jointing, pointing and chemical polishing complete all as specified. | Sqm | 3837 |
| 12-45 | Same as item 12-44 but **Deluxe quality granite tiles** (Black, Cobra, Rao silk, Sea green, Chagi pink, Paradizo), all as specified. | Sqm | 6634 |
| "12-46 | Same as item 12-44 but **Premium quality granite tiles** (Chilly red, Goffe brown, Gibrana, Baltic brown, Red Rubi, Cherry pink, Cherry brown), all as specified. | Sqm | 9927 |
| | **Mosaic Tiles** | | |
| 12-47 | Providing and laying, **Mosaic tiles, 300 mm x 300 mm x 25 mm of white cement,** on walls and floors laid, set in CM (1:2) and joints grouted with white/ coloured cement, chemical polished, complete. | Sqm | 1713 |
| 12-48 | Same as item 12-47 but in **ordinary cement.** | Sqm | 1555 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 12-49 | Same as item 12-35 to 12-48 but fixing only. | Sqm | 670 |
| 12-50 | Add to item 12-47 to 12-48 for labour only for each storey above 2nd floor. | Sqm | 120 |
| 12-51 | Providing and laying of dry bond, all as specified. | Sqm | 132 |
| | **Pointing** | | |
| 12-52 | **Racking out joints** of old floors, roofs etc. with brick laid on edges, built in any mortar, including preparing surface for re-pointing. | Sqm | 141 |
| 12-53 | Same as item 12-52 but with bricks or tiles laid flat. | Sqm | 107 |
| 12-54 | **Pointing Flush** in CM 1:3, to old or new brick floors laid on edge. | Sqm | 305 |
| 12-55 | Same as item 12.,54, but bricks laid flat. | Sqm | 197 |
| 12-56 | Three applications of Sodium Silicate on concrete surface. | Sqm | 103 |
| | **Floor Toping** | | |
| 12-57 | Providing and laying, **Floor Toping** 50 mm thick with PCC 3000psi compressive cylindrical strength all as specified (Steel reinforcement to be paid under Section-9). | Sqm | 747 |
| 12-58 | Providing and laying, **Bond Breaking materials,** using 0.102 mm thick Polythene film, over normal thickness of concrete floor. | Sqm | 372 |
| 12-59 | Providing and laying, **Screed bed** 50 mm thick on bond bre king material as specified. | Sqm | 1235 |
| | **PVC Floor Tiles** | | |
| 12-60 | Supply and fix, **PVC Floor Plain / Textured Tiles, 2 mm thick.** | Sqm | 1449 |
| 12-61 | Same as item 12-60 but **3 mm thick.** | Sqm | 1780 |
| 12-62 | Same as item 12-60 but **5 mm thick.** | Sqm | 2467 |
| 12-63 | Supply and fix, **PVC Floor Plain / Textured Sheet, 2 mm thick.** | Sqm | 1648 |
| 12-64 | Same as item 12-63 but **3 mm thick.** | Sqm | 2312 |
| 12-65 | Supply and fix, **Anti-Static Tile, 3 mm thick** (Copper strips measured and paid separately). | Sqm | 3246 |
| | **Carpet / Artificial Wooden/ Laminated Tiles** | | |
| 12-66 | Supply and fix **Carpet Tiles** with glue as per manufacturer's specifications. | Sqm | 3312 |
| 12-67 | Providing and laying **artific;ial wooden / laminated tiles, 8 mm thick,** all as specified. | Sqm | 2358 |
| 12-68 | Same as item 12-67 but **12 mm thick.** | Sqm | 4829 |
| | **Artificial Stone Facade Tiles** | | |
| 12-69 | Providing and laying, **Artificial Stone facade tiles,** of any colour and size, all as specified. | Sqm | 1306 |
| 12-70 | Providing and laying, **Gutka facade tiles** of any colour and size, all as specified. | Sqm | 1953 |
| | **Plinth Protection** | | |
| 12-71 | Providing and laying, **75 mm thick PCC 1:2:4** using crushed stones, surface finished, smoothened with cement and steel trowel, including form work as **plinth protection.** | Sqm | 541 |
| | **Cladding / Panelling (Aluminium, PE, PVDF)** | | |
| 12-72 | Providing and fixing, **Aluminium Cladding** upto any height with sheets of any size and shape using **0.5 mm thick Aluminium sheet, 3 mm thick PE (polyethylene)** or **0.5 mm thick Aluminium sheet PVOF (Poly Vinyl Deni Flouride)** coated, in any colour/ texture with framing, complete, all as specified. | Sqm | 5665 |
| 12-73 | Same as item 12-72 but, using **0.4mm thick Aluminum sheet, 3.20 mm thick PE (polyethylene)** or **0.4 mm thick Aluminium sheet PVDF (Poly Vinyl Deni Fluoride)** coated, all as specified. | Sqm | 4855 |

SECTION-13

# PLASTERING

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-13
# PLASTERING

## SPECIFICATIONS

**13.0.** This section covers all operations in connection with cement and mud plastering.

## MATERIAL REQUIREMENTS

**13.1. Clay.** Mud shall be composed of stiff Clay.

**13.2. Chopped straw/ Fibre.** Chopped straw, (not less than 25 mm long), fibre or other similar and approved long binding material.

**13.3. Water**

13.3.1. The quality of mixing water shall be determined by AASHTO methods of sampling and testing designation T-26. Water used in plaster shall be clean and free from injurious amount of acids, alkalis, salts, organic material or substances deleterious to plaster.

13. 3.2. The other required characteristics for curing, mixing, It shall be free from oil and neither contain more than 1,000 ppm of Chlorides nor more than 1,300 ppm of Sulphates (SO4).

**13.4. Cement.** The cement shall be as specified in Section 3.3.1 (Type-I) Ordinary Portland, Normal Setting of any brand, unless, otherwise, specified to be of any particular type / quality.

**13.5. Sand.** Sand shall be from approved source and free from dust and salt. For additional explanation, refer to Para 4.3, Section- 4.

**13.6. Admixture.** As defined in Section 3.6.

**13.7. Water Proof Drying System Additive.** Air-entraining plasticizing hydrophobic natural admixture for plastering mortars to improve workability, cohesion, adhesion, ease of application process, resistant to hairline cracks, and to enable application on humid or wet masonry substrate. When mixed with cement and sand into plaster either industrially (instant version) or manually at construction site (site mix version), it creates plaster, render or skim coat called water proof drying system (WDS). WDS product modified with additive is 100% water proof and simultaneously, it is extremely breathable and prevents salt crystallisation and creation of maids and fungi. WDS product constantly dries out moisture from the substrate.

## CONSTRUCTION REQUIREMENTS

**13.8. Mud Plaster.** Mud plaster shall be composed of stiff clay to which shall be added equal bulk of chopped straw. The Clay, which may if required, contain a small quantity of sand not exceeding 5%, shall be laid out in stacks not exceeding 300 mm high and saturated with water. The water is allowed to stand for not less than three days. During this period, water is added as required, to ensure complete saturation. The binding material (clay) shall then be added and the mixture well puddled and left for two days to soak. It will then be thoroughly mixed (water is added, if required) to the consistency of stiff mortar. The mud plaster shall be floated smooth and level, and when dry, will be given a coat of leeping 3 mm thick as given below:-

(1) Leeping shall be made with a mixture of clay and cow dung in equal parts and trowelled or floated smooth. A small quantity of Sand may be added to the mixture, if so ordered.

(2) Leeping must be free from seeds, grass, straw and other impurities.

**13.9. Cement Plaster.** It shall be composed of cement and washed sand, mixed in the proportions specified. The plaster shall be applied in one or two coats / layers work, as may be ordered. Admixture may be used for external coverings in coastal area to encounter humid and saline environment.

**13.10. Dubbing Out.** All irregularities in wall shall be dubbed out with mortar of the same specification and consistency as the plaster coat/layer.

## METHOD OF MEASUREMENTS

**13.11. Measurement.** All work be measured net and flat (not girthed).

**13.12. Openings.** No deduction or addition shall be made for opening not exceeding 0.4 Sqm. For mud plaster, openings shall not be deducted, when the jambs are plastered and no addition will be made for the jambs. For cement plaster, after deduction of openings; jambs, soffits and sills be added separately.

**13.13. Ends.** No deduction shall be made for ends of joints, beams, posts, steps etc. not exceeding 900 Sq cm.

**13.14. Thickness.** Thickness of plaster, specified, is the thickness when dry, and exclude any key or dubbing out and is taken from face of lathing or walls.

## CLARIFICATION OF RATES

**13.15.** The rates, inter alia, include particularly:-

(1) Fair and even surfaces where exposed, finished with steel trowel, or wooden float.
(2) Work on ceilings, walls or other positions and in patches (roof/ floor excluded).
(3) Work of any widths, including coving.
(4) Straight or curved work.
(5) Small labour (chamfers, rounds, coves) not exceeding 75 mm, mitres, turns, etc.
(6) Dubbing out of irregular surfaces.
(7) Blocking out pieces to beams etc., as required.
(8) All labour in rounding off internal and external angles In plaster.

## ITEM RATES

| Sl No. | Description | Unit | Rate (Rs)l |
|---|---|---|---|
| | **Mud Plaster** | | |
| 13-1 | **Mud Plaster, 19 mm thick** including 3mm thick leaping. | Sqm | 348 |
| 13-2 | Same as item 13-1 but **25 mm thick,** all as specified. | Sqm | 430 |
| | **Cement Plaster** | | |
| 13-3 | **Cement Plaster 1:3, 13 mm thick** finished as specified (Basement, GF, FF and 2nd floor). | Sqm | 340 |
| 13-4 | Same as item 13-3 but **1:4,** all as specified. | Sqm | 322 |
| 13-5 | Same as item 13-3 but **1:6,** all as specified. | Sqm | 302 |
| 13-6 | **Cement Plaster 1:3, 19 mm thick** finished as specified (Basement, GF, FF and 2nd floor). | Sqm | 447 |
| 13-7 | Same as item 13-6 but **1:4,** all as specified. | Sqm | 423 |
| 13-8 | Same as item 13-6 but **1:6,** all as specified. | Sqm | 397 |
| 13-9 | **Rough Cast Plaster 1:2, 6 mm thick** using 3mm aggregate, all as specified. | Sqm | 378 |
| 13-10 | Same as item 13-9 but **12 mm thick,** all as specified. | Sqm | 532 |
| 13-11 | Add to item 13-3 to 13-10 for additional labour above 2nd floor. | Sqm | 137 |
| 13-12 | Deduct from item 13-3 to 13-8 if fair face not required, all as specified. | Sqm | 33 |
| | **Scraping Plaster** | | |
| 13-13 | **Hacking out** Cement Plaster of walls or lathing, racking out joints when required, or racking out cement jointing to walls, roofs or floors of any description, or hacking out concrete to form key, or dismantling, lathing with or without plaster. | Sqm | 158 |
| 13-14 | **Scraping, Leaping or Mud Plaster,** any thickness. | Sqm | 38 |
| 13-15 | **Filleting** exceeding 40 mm but not exceeding 75 mm wide and upto 50 mm deep, in any position, in CM 1:3. | Metre | 62 |
| 13-16 | Same as item 13-15, but exceeding 75 mm and not exceeding 150 mm wide, all as specified. | Metre | 82 |
| 13-17 | Forming **V-grooves** 1'3' mm wide and 10 mm deep in new plaster. | Metre | 110 |
| 13-18 | Forming 13 to 19 mm thick Drip Course 50 mm in cement plaster CM (1:3), all as specified. | Metre | 167 |
| 13-19 | Add to item 13-3 if water proof drying system material mixed with cement at the rate of 12% by weight. | Sqm | 562 |
| 13-20 | Add to item 13-4 if water proof drying system material mixed with cement at the rate of 12% by weight. | Sqm | 374 |
| 13-21 | Add to item 13-5 if water proof drying system material mixed with cement at the rate of 12% by weight. | Sqm | 326 |
| 13-22 | Add to item 13-6 if water proof drying system material mixed with cement at the rate of 12% by weight. | Sqm | 749 |
| 13-23 | Add to item 13-7 if water proof drying system material mixed with cement at the rate of 12% by weight. | Sqm | 599 |
| 13-24 | Add to item 13-8 if water proof drying system material mixed with cement at the rate of 12% by weight. | Sqm | 434 |

# SECTION-14

# CEILING **AND PANELING**

# RECORD OF **AMENDMENTS**

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-14

# CEILING AND PANELING

## SPECIFICATIONS

**14.0.** This Section covers all operations pertaining to ceiling and paneling works using, Patent boards and sheets, Thermo-pore sheet, Fibre Glass, Gypsum board, Mineral (Acoustic), Dampa, Medium Density Fibre (MDF) / Soft Board, Plaster of Paris (Gypsum) and PVC/ uPVC etc.

## MATERIAL REQUIREMENTS

**14.1. Patent/ Hard Board Sheet.** Patent/ Hard board sheets shall be of approved quality.

**14.2. Medium Density Fibre Board (MDF) /Soft Board.** MDF board, 20mm thick, shall be approved by the Engineer-in-Charge before incorporation in the work.

**14.3. Thermo pore Sheet.** Thermopore sheet ceiling shall be of density not less than 35 Kg/Sqm and thickness 20mm. Shape and design be approved by the Engineer-in-Charge.

**14.4. Dampa Sheet.** Shall be of best quality as approved by the Engineer-in-Charge. All fittings/fixtures and system of hanging shall be followed strictly in accordance with manufacturer's instructions.

**14.5. Fibre Glass, Gypsum Board, and Mineral (Acoustic) Sheet.** These shall be of high grade and best quality as approved by the Engineer-in-Charge.

**14.6. Plaster of Paris (POP)/ (Gypsum).** POP tiles 600 mm x 600 mm and 20 mm thick of pattern approved by the Engineer-in-Charge.

**14.7. PVC/ uPVC Ceiling/ Paneling.** PVC/ uPVC Ceiling and Paneling of pattern and quality approved by the Engineer-in-Charge.

## CONSTRUCTION REQUIREMENTS

**14.8. Patent / Hard Board Sheet Ceiling/ Paneling.** The sheets shall be fixed Butt jointed, joints stopped and sheet drilled for and fixed with 30 mm galvanized or sherardized steel nails at 150 mm center and rows not exceeding one meter apart where practicable, or fixed according to manufacturer's instructions. The joints shall be covered with beveled edged Soft wood fillets, fixed with screws at not exceeding 300mm centers.

**14.9. MDF Board /Soft Board Ceiling / Paneling.** The false ceiling shall be suspended from the roof with Rawal plug or nut and bolt (for steel structure) arrangement. The vertical members shall be galvanized wire / strip of approved dimension. The MDF board shall be properly installed in "L" and "T" shape horizontal strips, as approved by Engineer-in-Charge.

**14.10. Thermo-pore Sheets Ceiling / Paneling.** The sheets shall be fixed Butt jointed, joints stopped, sheet drilled and fixed with 30 mm galvanized or sherardized steel nails at 150 mm center and rows not exceeding one meter apart, where practicable, or fixed according to manufacturer's instructions.

**14.11. Fibre Glass, Gypsum Board, Mineral (Acoustic) Ceiling / Paneling.** All fittings/fixtures and system of hanging shall be followed strictly in accordance with manufacturer's instructions.

**14.12. Plaster of Paris (Gypsum) Ceiling/ Paneling.** The sheet shall be drilled and fixed with counter sunk screws and making good with POP to hide the screw heads.

**14.13. Dampa Ceiling / Paneling.** All fittings/fixtures and system of hanging shall be followed in accordance with manufacturer's instructions.

**14.14. PVC / uPVC Ceiling / Paneling.** Shall be provided as per manufacturer's instruction to the shape and pattern as approved by the Engineer-in-Charge.

## METHOD OF MEASUREMENTS

**14.15. Measurements.** All work shall be measured net as fixed with, no allowance for cutting and waste, laps, seams turning, etc.

## CLARIFICATION OF RATE

**14.16.** The rates, inter alia, include particularly:-

(1) Fixing complete as specified in any position.
(2) All cutting and waste.
(3) Cutting holes for pipes, etc.
(4) Wooden frames, where provided, shall be paid separately.

**ITEM RATES**

| Sl No | Description | Unit | Rate (Rs)l |
|---|---|---|---|
| | **Hard Board Ceiling** | | |
| 14-1 | Supplying and fix, **Hard board sheets** not exceeding **4 mm thick,** fixed in ceiling and partitions with 1st Class Soft wood (Deodar), beveled edge, cover fillets, 50 mm x 13 mm, screwed on. | Sqm | 727 |
| 14-2 | Same as item 14-1, but **exceeding 4mm and not exceeding 6 mm thick sheet.** | Sqm | 772 |
| 14-3 | Same as item 14-1 or 14-2, but except cost of Hard board sheets. | Sqm | 382 |
| 14-4 | Add to item 14-1, 14-2 and 14-3, if fixed in repair. | Sqm | 71 |
| | **Soft Board Ceiling** | | |
| 14-5 | Supply and fix, **13 mm thick Soft board sheet,** fixed in ceiling and partitions, with 1st Class Soft wood (Deodar), beveled edge, cover fillet, 50 mm x 13 mm, screwed on. | Sqm | 940 |
| 14-6 | Same as item 14-5, but except cost of Soft board sheet. | Sqm | 382 |
| **14-7** | Same as item 14-5 or 14-6, if fixed in repair. | Sqm | 71 |
| 14-8 | Supply and fix, **13 mm thick, Chip board sheets,** fixed in ceilings and partitions, with 1st Class Soft wood (Deodar), beveled edge, cover fillets, 50 mm x 13 mm, screwed on. | Sqm | 859 |
| 14-9 | Same as item 14-8, but **20 mm thick.** | Sqm | 941 |
| 14-10 | Same as item 14-8 or 14-9, but except cost of Chip board sheets. | Sqm | 392 |
| 14-11 | Add to item 14-8 to 14-10, if fixed in repairs. | Sqm | 71 |
| | **Thermopore Ceiling** | | |
| 14-12 | Supply and fix, **Thermopore Tiles,** fixed in ceiling, partitions and dados etc., all as specified. | Sqm | 544 |
| 14-13 | Add to item 14-12, if fixed in repair. | Sqm | 71 |
| 14-14 | Supply and fix, **Thermopore Ceiling,** 600 mm x 600 mm x 20 mm tiles, along with Aluminium Tee and Aluminium angle, 25 mm x 25 mm x 1 mm, including hanger clips, jointing clips and GI wire 14 SWG etc., complete all as specified. | Sqm | 2021 |
| 14-15 | Add to item 14-14, if fixed in repairs. | Sqm | 291 |
| 14-16 | Replacement of **Thermo-pore Ceiling tiles** only, 600 mm x 600 mm x 20 mm. | Sqm | 578 |
| | **Campa Ceiling** | | |
| 14-17 | Supply and fix, **Campa Ceiling,** along with necessary components for fixing direct or suspending from the soffit complete, including provision of opening for light. | Sqm | 3984 |
| 14-18 | Add to item 14-17, if fixed in repairs. | Sqm | 729 |
| | **Fibre Glass Ceiling** | | |
| 14-19 | Supply and fix, **Fibre Glass Ceiling** (1200 mm x 600 mm) panels, single ply **(not less than 1 mm thick),** in any colour / texture, including Aluminium Tee and angle, 25 mm x 25 mm x 1 mm, hanger clips, jointing clips and GI 14 SWG wire etc. complete, including provision of openings for lights. | Sqm | 2379 |
| 14-20 | Same as item 14-19, but **2 mm thick sheet.** | Sqm | 3224 |
| 14-21 | Same as item 14-19, but **3 mm thick sheet.** | Sqm | 3979 |
| 14-22 | Add to item 14-19 to 14-21, if fixed in repairs. | Sqm | 291 |
| 14-23 | Replacement of **Fibre Glass Sheet,** single ply, **(not less than 1mm thick)** ceiling panels only , 1200 mm x 600 mm. | Sqm | 1038 |
| 14-24 | Same as item 14-23, but **2 mm thick, Fibre Glass sheet.** | Sqm | 2143 |
| 14-25 | Same as item 14-23, but **3 mm thick, Fibre Glass sheet.** | Sqm | 2906 |
| | **Plaster of Paris (POP) Ceiling** | | |
| 14-26 | Supply and fix, **POP Tiles** (600 mm x 600 mm x 20 mm), fixed in ceiling in any design, partitions and dados etc. | Sqm | 1211 |
| 14-27 | Add to item 14-26, if fixed in repairs. | Sqm | 291 |
| 14-28 | Supply and fix, **POP border,** in any shape and design, girth not exceeding 150 mm, complete. | Metre | 159 |

| Sl No | Description | Unit | Rate (Rs)I |
|---|---|---|---|
| 14-29 | Same as item 14-28, but girth exceeding 150 mm but not exceeding 300 mm, complete. | Metre | 221 |
| 14-30 | Add to item 14-28 and 14-29, if fixed in repairs. | Metre | 30 |
| | **Gypsum Ceiling** | | |
| 14-31 | Supply and fix Gypsum sheet 1200 mm x 2400 mm x 12.5 mm thick, including Aluminium Tee and Aluminium angle, 25 mm x 25 mm x 1 mm, including hanger clips, jointing clips and 14 SWG, GI wire etc., complete. | Sqm | 2027 |
| 14-32 | Same as item 14-31 but, **Gypsum Ceiling 600 mm x 600 mm x 7.5 mm thick,** all as specified. | Sqm | 1571 |
| 14-33 | Add to item 14-31 and 14-32, if fixed in repairs. | Sqm | 291 |
| 14-34 | Replacement of **Gypsum Tiles** only, **1200 mm x 2400 mm x 12.5 mm thick or 600 mm x 600 mm x 7.5 mm thick.** | Sqm | 814 |
| | **Mineral Acoustics Ceiling** | | |
| 14-35 | Supply and fix, **Mineral Acoustics Sheet Ceiling,** 600 mm x 600 mm x 12 mm thick including Aluminium Tee and Aluminium angle, framing 25 mm x 25 mm x 1 mm, including hanger clips, jointing clips and 14 SWG GI wire etc., complete. | Sqm | 2655 |
| 14-36 | Add to item 14-35, if fixed in repairs. | Sqm | 291 |
| 14-37 | Replacement of **Mineral Acoustic Ceiling** 600 mm x 600 mm x 12 mm, tiles only. | Sqm | 2613 |
| | **PVC/uPVC Sheet - Ceiling/Paneling** | | |
| 14-38 | Supply and fix, **PVC/uPVC Sheet Ceiling / Paneling,** 1.5 mm thick, as in wall paneling / ceiling (soffit of slab) including fittings in any size, pattern, shape, colour / texture, complete all as specified. | Sqm | 2027 |
| | **MDF Ceiling** | | |
| 14-39 | Supply and fix, **10 mm thick MDF** sheets ceiling, along with hanging arrangements, Aluminium 'Tee' and angle 25 mm x 25 mm x 1 mm, including hanger, clips, jointing clips etc., complete all as specified. | Sqm | 2392 |
| 14-40 | Same as item 14-39 but **16 mm thick MDF** sheets. | Sqm | 2878 |
| 14-41 | Add to item 14-39 and 14-40, if fixed in repairs. | Sqm | 291 |
| 14-42 | Replacement of **10 mm or 16 mm thick MDF** sheets only. | Sqm | 949 |

# SECTION - 15.

# FINISHES

# (DISTEMPERING ANO PAINTING)

# REGORD QF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-15

# FINISHES

## (DISTEMPERING AND PAINTING)

## SPECIFICATIONS

**15.0.0.** This section covers white / coloured washing, distempering, oiling, painting (internal and external) of all types, wallpapers, wood preservatives, tarring, epoxy paints, coating of acrylic based marble chips, roll on, special spray paints, textured paints like graffito, venetian grains and road marking paints etc.

## SUB SECTION 15-1

## WHITE / COLOUR WASHING/ DISTEMPERING

### MATERIAL REQUIREMENTS

**15.1.1. Cement Slurry.** Cement Slurry shall be of creamy consistency.

**15.1.2. Cement Oil Paint.** Shall be composed of 1.20 Kg Cement to 1 litre, double boiled Linseed oil.

**15.1.3. Distemper.** Will be obtained from the manufacturers approved by the Engineer-in-Chief. The distemper shall be of required shade. Vinyl based emulsions/ distempers are marketed under different trade names. For this Schedule, such products are equivalent of Oil Bound Distemper.

**15.1.4. Whitening.** Plaster of Paris (POP) is applied as below:-

(1) Required quantity of POP is soaked in such a way that a thin layer of water comes on top of material, once properly mixed from jelly.

(2) 2.5 Litres of Water is added to 1.0 Kg of jelly to form a mixture.

**15.1.5. Lime.** The lime for white/colour washing shall be ordinary Fat Lime of good quality.

### CONSTRUCTION REQUIREMENTS

**15.1.6. Preparatory Work.** For white washing, color washing, distempering, etc., shall consist of brushing with stiff broom to remove all loose lime, scales of distemper, removing nails, screws, plugs, etc, as required and stopping holes not exceeding 100 sq cm.

**15.1.7. Distempering.** The distemper shall be applied strictly in accordance with manufacturer's instructions.

**15.1.8. Whitening.** Give any number of coats required to produce a well covered, smooth bodied, opaque surface.

**15.1.9. White / Colour Washing**

(1) The lime is to be slaked at site with an excess of water to the consistency of a cream and allowed to remain under water for 2 days.

(2) The mixture shall then be strained through coarse cloth and gum water (mixture of 100 grams gum to one litre of water) added as directed.

(3) The white wash shall be applied with proper fiber brushes.

(4) For colour washing, colouring material is to be boiled in water, and gum water added to form a uniform texture and finally mixed with strained white wash.

**15.1.10. Cleaning.** Protect all surfaces liable to splashing, clean all splashes of neighbouring work and leave whole of the premises clean.

### METHOD OF MEASUREMENTS

**15.1.11. Measurements.** All surfaces flat (not girths) whether plain or corrugated.

**15.1.12.** No addition shall be made for attachments to surfaces, as casings, pipes, timber etc., which are distempered or lime washed and no deduction shall be made for such attachments, if, not distempered or lime-washed etc.

**15.1.13. Openings.** No deduction or addition shall be made for openings, not exceeding 0.4 Sqm. Openings shall not be deducted, when the jambs are distempered or lime washed and no addition will be made for the jambs. No deduction to be made for ends of joists, beams, etc.

## CLARIFICATION OF RATES

**15.1.14.** The rates, inter alia, include particularly:-

(1) Preparatory works.
(2) Protective works against splashes and cleaning of splashes.
(3) Distemper of any tint (variety/ colour).
(4) Preparation of lime/ whitening use.
(5) Work on surfaces of any materials in any position.
(6) The use of cradles etc, where required, particularly for convenience of inspection.

## SUB SECTION 15-2

## OILING, PAINTING AND LETTERING

### MATERIAL REQUIREMENTS

**15.2.1. Paints** shall be of the best quality and will be obtained from manufacturers approved by Engineer-in-Chief.

**15.2.2. Oiling Woodwork.** The oil shall be a mixture of 450 grams beeswax, 0.20 litre of turpentine and 2.25 litres boiled linseed oil. It is enough for oiling 75 Sqm surface of wood work.

**15.2.3. Camouflaging Paint.** Shall be obtained from manufacturers approved by the Engineer-in-Chief.

**15.2.4. Wallpaper.** Wallpaper plain or decorative shall be of best quality, approved by the Engineer-in-Charge.

**15.2.5. Epoxy Paints.** Epoxy paints/ products shall be procured from manufacturers approved by the Engineer-in-Chief.

**15.2.6. Wall / Floor Coating**

15.2.6.1. **Acrylic Based Marble Chips Coating.** It is used for internal and external surfaces as a permanent protective covering that can be applied on any surface like wood, CC and cement plaster etc. It is composed of acrylic resins, specially graded natural marble chips in different colour, viscosity, setting agents, additives against bacteria, fungi and other harmful insects. Water is used as solvent.

(1) Roll sand with acrylic premier base for external use.

(2) Malir sand / colour Crete with grooves for external use.

(3) Anti-bacterial finishes/ coating on walls and floors of hospital.

(4) Anti-bacterial epoxy flooring for Hospital.

(5) Anti-microbial powder coating for surface.

15.2.6.2. **Textured Coatings**

(1) **Roll on Wall Coating.** It is a textured wall coating composed of acrylic copolymer emulsion in organic pigments, silica, powder of quartz and various other additives like antibacterial and anti fungal agents etc.

(2) **Spray Wall Coating (Zola etc.).** It is a textured wall coating composed of acrylic copolymer emulsion in organic pigments, silica, powder of quartz, marble grains and various other additives like antibacterial and anti fungal agents etc.

(3) **Granular Wall Coating (Graffito etc.).** It is wall coating of variable granular material and is composed of acrylic copolymer emulsion, spheroid quartz, various additives, metallic oxides, inerts of different granulemetries, colouring agent, antibacterial and anti fungal agents etc.

(4) **Venetian Grain Wall Coating.** It is composed of acrylic copolymer emulsion, marble chips, grains, metallic oxides inerts, colouring agents, antibacterial and antifungal agents.

(5) **Weather Resistant Coatings.** It is used as permanent protective covering for external surface and can be applied on any type of surface based on wood, CC and cement plaster. It is composed of acrylic resins of different colour, viscosity setting agents, additives against bacteria, fungi and other harmful insects. Water is used as a solvent.

**15.2.7. Epoxy Coating for POL Tanks.** Material shall be as per Technical Instruction M-25, Volume V issued by Engineer-in-Chief's Branch.

**15.2.8. Road Marking Paint.** Shall be obtained from manufacturer approved by the Engineer-in-Chief.

**15.2.9. Wood Preservative.** It shall be from the manufacturers approved by the Engineer in Chief. Creosote shall comply with BS No.144.

### CONSTRUCTION REQUIREMENTS

**15.2.10. Painting**

(1) Painting, as far as possible is carried out in dry weather.

(2) Paint to be applied with proper paint brushes of good quality, carefully maintained throughout the work, so as to be always pliable and free from loose bristles and w'ell worked over the surface.

(3) Where more than one coat is specified, each coat is to be of a different shade and be passed by the Engineer-in-Charge, before next coat is started.

(4) The faces of all new priming and undercoats to be properly rubbed with pumice stone or sand paper and well dusted.

(5) If old paint is unsound, it shall be entirely removed by burning off or using suitable paint remover. Burning off or stripping of old paint will not be done, unless, specifically, ordered in writing by the Engineer-in-Charge.

**15.2.11. Oiling Woodwork.** The oil and wax are to be mixed by heating the wax slowly till it melts and then turpentine is added. Boiled linseed oil and not raw linseed oil be used to facilitate drying.

**15.2.12. Oiling with Crude or Creosote.** Shall be applied, as thickly as practicable in one coat, so as to cover completely, all surface to be treated. The material shall be worked in with a brush.

**15.2.13. Tarring.** Tar shall be heated near boiling point and 200 grams of unslaked lime added to each litre of tar. The mixture shall be thinned with 1 part of kerosene to 4 parts of tar by volume and applied hot.

**15.2.14. Painting New or Old Wood surfaces, from where paint has been burnt or removed.** Painting shall be done in following order:-

(1) **Knotting.** Knots and resinous portions shall be coated with two thin coats of paint knotting well brushed in.

(2) **Stopping.** All crevices, cracks or holes shall be thoroughly cleaned out and filled up with thick coat of white lead paint or putty.

(3) **Touching up.** All the knots, crevices, cracks and holes treated as above (not the whole surface to be painted) shall be touched up with an even coat of primer and restored, where damaged or defaced and the entire work left free from blemishes.

(4) **Priming Coat or Under Coat.** The entire surface will be painted with pink primer, manufactured by any of the manufacturer's specified for paints for first coat or pink paint obtained by a mixture of white and red lead paint.

(5) **First coat.** Apply thick coat of paint of required shades.

(6) **Second and Subsequent Coats.** Apply a thin coat of paint as specified for the first coat.

**15.2.15. Painting Old Wood.** Painting on old surface shall be done in the following order:-

(1) **Washing down.** Surfaces are to be well rubbed down with pumice or soapstone, to remove all blisters, scales of old paint etc, and greasy spots rubbed and removed with turpentine. The surface is to be then well washed with soap and water.

(2) **Filling cracks.** All holes and cracks shall be filled up with putty to an even smooth surface.

(3) **Touching up in patches.** All patches rendered naked by "washing down" shall be touched up with primer to the tint of the required paint.

(4) **First Coat.** Apply thick coat of paint obtained from the manufacturers approved by the Engineer-in-Chief, specified for new surface.

(5) **Second and subsequent Coats.** Apply a thin coat of paint obtained from the manufacturers approved by the Engineer-in-Chief, specified for new surface.

**15.2.16. Painting Steel and Iron work**

15.2.16.1. New Surfaces or old Surfaces from where paint has been burnt or removed:-

(1) All mill scale, rust scales, etc, be removed by means of heavy steel scraps or steel wire brush and well dusted.

(2) **Priming Coats.** To be Oxide of Iron paint or Red Lead or obtained from manufacturers approved by the Engineer-in-Chief, specified for First coat of paint on new steel/ iron surface.

(3) **Second and Subsequent Coats.** To be Oxide of Iron or Lead based paint as ordered or paints obtained from manufacturers approved by the Engineer-in-Chief.

15.2.16.2. **Painting Old Surface**

(1) If the existing paint is not ordered to be removed, remove all blisters, scales of old paint, rust etc, and dust the surface.

(2) Surfaces, which become naked by the above process, will be treated with primer coat.

(3) When thoroughly dry, one or two coats shall be applied as ordered.

**15.2.17. Enamel Paint to Plastered Surface/ Wood/ Steel Work.** The surface shall be applied with one primer and two subsequent coats of paint as per manufacturer's instructions. The painted surface shall finally produce a glossy/ matt finish as approved by the Engineer-in-Charge.

**15.2.18. Camouflage Paint.** Shall be applied strictly in accordance with manufacturer's instructions.

**15.2.19. Wallpaper**

15.2.19.1. The wall surface to be absolutely dry and smooth. Any dampness shall be dried by one of the improvised methods and roughness removed by sand-paper, before the paper placed on the wall.

15.2.19.2. The adhesive used for paper hanging is ordinary stiff floor paste. The adhesive manufactured and marketed for this purpose by a proprietary firm shall be used. No other material shall be allowed.

15.2.19.3. The pqper hanging is done by experienced skilled men.

15.2.19.4. Any particular instructions by the manufacturer of wallpaper regarding the type of adhesive and system of hanging shall be followed in full.

**15.2.20. Epoxy Paints.** Epoxy paints / products shall be applied strictly in accordance with manufacturer's instructions.

**15.2.21. Wall Coating**

15.2.21.1. **Acrylic Based Marble Chips Coating.** It shall be applied with a stainless steel trowel and after the application has been worked over, smoothen out the application and compact until uniform surface is achieved. Keep steel trowel clean with wet clean cloth during every operation.

15.2.21.2. **Textured Coatings**

(1) **Roll on Wall Coating.** Shall be applied with wood roller and finishing coat is applied with sponge roller.

(2) **Spray Wall Coating (like Zola).** First Base coat shall be applied with wooden roller and finishing coat is applied with compressor spray gun.

(3) **Granular Wall Coating (like Graffito).** Shall be applied with stainless steel trowel and will be finished with plastic trowel. To get straight texture, plastic trowel is moved vertically and the trowel is rotated to obtain swirl texture.

(4) **Venetian Grain Wall Coating.** Shall be applied as granular wall coating.

(5) **Weather Resistant Coatings.** Shall be applied strictly in accordance with the manufacturer's instructions. Drying period of the coating is three hours. Care be taken not to touch it by hands, during the drying period and contact with eyes or skin be avoided.

**15.2.22. Epoxy Coating for POL Tanks.** Apply as per Technical Instruction M-25 Volume V, issued by E-in-C's Branch, and will be strictly followed.

**15.2.23. Road Marking Paints.** Shall be used as per manufacturer's instructions and as approved by the Engineer-in-Charge.

**15.2.24. Wood Preservative.** Shall be applied as per manufacturer's instructions and as approved by the Engineer-in-Charge.

## METHOD OF MEASUREMENTS

**15.2.25. Oiling.** Will be paid per cum as per quantity of timber measured.

**15.2.26. Attachment.** No extra shall be paid for oiling or painting of attachment (block, wooden handles, etc.) in a similar manner to the main work.

**15.2.27. Measurements.** Matched boarding, boarding with cover fillets, corrugated sheeting etc., shall be measured net and flat (not girthed). Boarding with faces and edges exposed shall be measured over the faces only.

**15.2.28. Doors and Windows.** Shall be measured on both sides. Portion of doors sashed or with panels left out shall not be measured separately from doors with panels and no deductions shall be made for glass or panels left out.

**15.2.29. Trellis (Jali/ Grill) Work.** Iron guard bars, iron bar gates, grating and railing etc. shall be measured on one side only, but shall be coated on all exposed faces.

**15.2.30. Oiling or Tarring.** Second coat will only be paid, if, specially ordered by the Engineer-in-Charge.

## CLARIFICATION OF RATES

**15.2.31.** The rates, inter alia, include particularly:-

(1) Cleaning and preparing all surfaces for the application of wood preservatives, tar, paint etc.

(2) Work on surfaces of any material in any position.

(3) The rates apply to paint of any base or colour or tint.

(4) The use of cradles, where required particularly for convenience of inspection etc., by the Engineer-in-Charge.

(5) Rates for priming coat, which is for new work will include knotting, stopping and under coat on crevices, cracks or holes.

(6) Rates for washing down, which are for old work, will include rubbing, filling cracks with putty and under coat on naked patches.

(7) Protective works against splashes and cleaning of splashes.

**15.2.32.** The rates in Section-9 (Iron and Steel Work) with the exception of sheets, steel work, sheet iron pipes, reinforcement and galvanized work, including painting with one coat of paint before fixing and one coat after fixing.

**ITEM RATES**

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 15-1 | **Cenie'nt Slurry wash,** on new /old surface per coat. | Sqm | 19 |
| 15-2 | **White or Colour wash** on new /old surface, **1st Coat.** | Sqm | 20 |
| 15-3 | Same as item 15-2, but **2nd and subsequent coats.** | Sqm | 15 |
| 15-4 | Distempering with **Poly Vinyl Distemper** or equivalent, on new or old surface, **1st Coat.** | Sqm | 61 |
| 15-5 | Same as item 15-4, but **2nd and subsequent coats.** | Sqm | 36 |
| 15-6 | **Whitening** surface of soft board ceiling etc. with POP on new or old surface, **1st Coat.** | Sqm | 21 |
| 15-7 | Same as item 15-6, but **2nd and subsequent coats.** | Sqm | 16 |
| 15-8 | **Removing** white / colour wash, distemper, plastic emulsion paint and weather resistant paintfrom plastered/ un-plastered surface. | Sqm | 53 |
| | **Tarring** | | |
| 15-9 | **Tarring** on any plain surface, **one coat.** | Sqm | 119 |
| 15-10 | Same as item 15-9, but **two coats.** | Sqm | 203 |
| | **Painting Wood Work** | | |
| 15-11 | **Prime Coat** on new wood work such as timber work in ceiling timber boarding etc., of any description, as specified. | Sqm | 140 |
| 15-12 | **1st Coat of painting** on new or old work such as timber work ceiling and timber boarding etc. of any description with **synthetic enamel paint.** | Sqm | 97 |
| 15-13 | Same as item 15-12, but **second and subsequent coat.** | Sqm | 82 |
| 15-14 | **Prime coat** on new work such as glazed or gauzed window and fanlight, as specified. | Sqm | 137 |
| 15-15 | **1st Coat of painting** on new or old work such as glazed or gauzed window and fanlight, with **Synthetic Enamel paint.** | Sqm | 114 |
| 15-16 | Same as item 15-15, but **second and subsequent coat.** | Sqm | 103 |
| 15-17 | **Primer Coat** on new work such as doors of any type and description as specified. | Sqm | 153 |
| 15-18 | **1st Coat of painting** to new or old work such as doors of any type and description with **synthetic enamel** paint. | Sqm | 110 |
| 15-19 | Same as item 15-18, but **2nd and subsequent coat.** | Sqm | 95 |
| 15-20 | **Primer coat** on new work such as fillets, framings, skirting and similar work not exceeding 150 mm in girth as specified. | Metre | 13 |
| 15-21 | **1st coat of painting** on new or old work such as fillets, framings, skirting and similar work not exceeding 150 mm girth with **Synthetic Enamel Paint.** | Metre | 07 |
| 15-22 | Same as item 15-21, but **second and subsequent coat.** | Metre | 05 |
| 15-23 | **Primer coat** on new work such as detached articles not exceeding 900 Sqcm, as specified. | C.No | 682 |
| 15-24 | **1st coat of painting** on new or old work such as detached articles not exceeding 900 Sqcm with **Synthetic Enamel Paint.** | C.No | 492 |
| 15-25 | Same as item 15-24, but **2nd and subsequent coat.** | C.No | 354 |
| | **Painting Steel and Iron Work** | | |
| 15-26 | **1st Coat of painting** on new or old work such as steel doors, windows and CSWs of any type and description with **Synthetic Enamel paint.** | Sqm | 87 |
| 15-27 | Same as item 15-26, but **2nd and subsequent coat.** | Sqm | 61 |
| 15-28 | **1st Coat of painting** on new or old work such as iron guard bars, iron bars gates, railing and similar open work with **Synthetic Enamel paint.** | Sqm | 67 |
| 15-29 | Same as item 15-28, but **2nd and subsequent coat.** | Sqm | 46 |
| 15-30 | **1st Coat of painting** on new or old work such as plain and corrugated sheets in roofs, partitions etc. with **Synthetic Enamel paint.** (measured flat not girthed). | Sqm | 95 |
| 15-31 | Same as item 15-30, but **2nd and subsequent coat.** | Sqm | 65 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 15-32 | **1st Coat of painting** on new or old work such as pipes, gutters and similar work not exceeding 150mm in girth with **Synthetic Enamel paint.** | Metre | 14 |
| 15-33 | Same as item 15-32, but **2nd and subsequent coat.** | Metre | 10 |
| 15-34 | **1st Coat of painting** on new or old work such as detached articles not exceeding 900 Sqcm with **Synthetic Enamel paint.** | C.No | 855 |
| 15-35 | Same as item 15-34, but **2nd and subsequent coat.** | C.No | 586 |
| 15-36 | **1st Coat of painting** on new or old surfaces of any description of steel with **Red Oxide** paint. | Sqm | 95 |
| 15-37 | Same as item 15-36, but **2nd and subsequent coat.** | Sqm | 83 |
| 15-38 | **1st Coat of painting** on new or old work such as iron guard bars, iron bar gates, gratings, railings and similar open work, with **Red Oxide** paint. | Sqm | 70 |
| 15-39 | Same as item 15-38, but **2nd and subsequent coat.** | Sqm | 65 |
| 15-40 | **1st Coat of painting** on new or old work such as pipes, gutters and similar work not exceeding 150 mm in girth with **Red Oxide** paint. | Metre | 14 |
| 15-41 | Same as item 15-40, but **2nd and subsequent coat.** | Metre | 12 |
| 15-42 | **1st Coat of painting** of new or old work such as detached articles not exceeding 900 Sq cm with **Red Oxide** paint. | C.No | 855 |
| 15-43 | Same as item 15-42, but **2nd and subsequent coat.** | C.No | 750 |
| | **Aluminium Painting** | | |
| 15-44 | **1st Coat of painting** on new or old work such as steel doors and window with **Aluminium paint.** | Sqm | 95 |
| 15-45 | Same as item 15-44, but **2nd and subsequent coat.** | Sqm | 67 |
| 15-46 | **1st Coat of painting** on new or old such as corrugated sheets in roofs, partitions, etc., (measured flat and not girthed) with **Aluminium paint.** | Sqm | 87 |
| 15-47 | Same as item 15-46, but **2nd and subsequent coat.** | Sqm | 71 |
| 15-48 | **1st Coat of painting** on new or old work such as pipes, gutters, and similar work not exceeding 150mm internal dia with **Aluminium paint** | Metre | 14 |
| 15-49 | Same as item 15-48, but **2nd and subsequent coat.** | Metre | 10 |
| 15-50 | **1st Coat of painting** on new or old work such as detached articles not exceeding 900 Sq cm with **Aluminium paint.** | C.No | 851 |
| 15-51 | Same as item 15-50, but **2nd and subsequent coat.** | C.No | 598 |
| | **Painting on Plastered Walls** | | |
| 15-52 | surface preparation (for dampness) by prov1s1on of a film with **Alkali Resisting primer** on plastered wall or ceiling. | Sqm | 101 |
| 15-53 | **1st Coat of painting** on new or old work such as walls including all detached attachment with Plastic Emulsion paint. | Sqm | 81 |
| 15-54 | Same as item 15-53, but **2nd and subsequent coat.** | Sqm | 57 |
| 15-55 | **1st Coat of painting** on new or old pipes, picture rails, dados etc. 150mm in girth with **Plastic emulsion paint.** | Metre | 14 |
| 15-56 | Same as item 15-55, but **2nd and subsequent coat.** | Metre | 10 |
| 15-57 | **1st Coat of Weather Resistant paint** on exterior wall for old surface. | Sqm | 158 |
| 15-58 | **1st Coat of Weather Resistant paint** on exterior wall on new surface. | Sqm | 125 |
| 15-59 | Same as item 15-57 and 15-58, but **2nd and subsequent coat.** | Sqm | 93 |
| 15-60 | **1st coat of texture paint** on any surface complete all as specified. | Sqm | 61 |
| 15-61 | Same as item 15-60 but **2nd and subsequent coat.** | Sqm | 58 |
| 15-62 | Add to item 15-57 to 15-61; additional labour for 2nd and each subsequent storey for painting of exterior surfaces only. | Sqm | 39 |
| 15-63 | **One Coat of painting with varnish** on surface of any description. | Sqm | 94 |
| 15-64 | Same as item 15-63 but on linear work not exceeding 150 mm girth. | Metre | 14 |
| 15-65 | Same as item 15-63 but to small detached articles as locks, latches, soot doors and frames, casement fasteners. etc. | C.No | 843 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Burning Old Paint** | | |
| 15-66 | **Burning off old paint** (or removing by chemicals where burning is not allowed). | Sqm | 92 |
| 15-67 | Washing down old wood work. | Sqm | 66 |
| | **Polishing** | | |
| 15-68 | **Wax polishing** to wood work (complete rate). | Sqm | 281 |
| 15-69 | **Spirit polishing** to new wood work (complete rate); | Sqm | 201 |
| 15-70 | Same as item 15-69, but old wood work. | Sqm | 183 |
| 15-71 | **Spirit polishing** to sashes glazed or gauzed, new work (complete rate). | Sqm | 151 |
| 15-72 | Same as item 15-71, but old work. | Sqm | 137 |
| 15-73 | **Matt Lacquer polishing** wi h two coats as per specification. | Sqm | 336 |
| 15.:.74 | **Lacquer polish** to wood work (complete rate). | Sqmm | 399 |
| | **Road Marking** | | |
| 15-75 | **Road Marking paint** on any new or old surface by using mechanical means, **1st coat.** | Sqm | 166 |
| 15-76 | Same as item 15-75, but **2nd and subsequent coat.** | Sqm | 121 |
| 15-77 | Providing and spreading of **glass sphere** on top surface of road marking paint. | Sqm | 35 |
| 15-78 | **Runway Marking** quick rubber based paint on any new or old surface all as specified, **1st coat.** | Sqm | 788 |
| 15-79 | Same as item 15-78 but **2nd and subsequent coat.** | Sqm | 421 |
| | **Camouflaging Paint** | | |
| 15-80 | **Camouflaging paint** on new or old work, **1st Coat.** | Sqm | 132 |
| 15-81 | Same as item 15-80, but **2nd and subsequent coat.** | Sqm | 118 |
| 15-82 | Supply and fix **Wallpaper,** plain or deoorative, best quality, all as specified. | Sqm | 1851 |
| | **Epoxy Paint** | | |
| 15-83 | **1st Coat of Epoxy Red Oxide Zinc Chromate** primer on steel surface, new or old work, as specified. | Sqm | 156 |
| 15-84 | Same as item 15-83, but **2nd and subsequent coat.** | Sqm | 143 |
| 15-85 | **1st Coat of Epoxy finish** on steel surface, new or old work, as specified. | Sqm | 166 |
| 15-86 | Same as item 15-85, but **2nd and subsequent coat.** | Sqm | 143 |
| 15-87 | **One Coat of Epoxy protective primer** on blast cleaned surface of new/ old work. | Sqm | 148 |
| 15-88 | **1st Coat of Epoxy Coal tar** to concrete or steel work new or old work as specified. | Sqm | 191 |
| 15-89 | Same as item 15-88, but **2nd and subsequent coat.** | Sqm | 155 |
| 15-90 | **1st Coat of Epoxy Concrete Finish,** to concrete or plastered surface, new/ old work as specified. | Sqm | 187 |
| 15-91 | Same as item 15-90, but **2nd Coat.** | Sqm | 155 |
| 15-92 | **1st Coat of Epoxy finish** on steel surface, new or old work, as specified. | Sqm | 287 |
| 15-93 | Same as item 15-92, but **2nd and subsequent coat.** | Sqm | 251 |
| 15-94 | Filling / Sealing of cracks in concrete or plastered surface, with **Epoxy sand mortar.** | Metre | 114 |
| | **Wall Coatings** | | |
| 15-95 | Wall finish, coat of **Acrylic based Marble chips** coating (Mesh-16 large) 1.00 mm to 2.00 mm thick, in any colour. (No extra coating of water repellent is required). | Sqm | 799 |
| 15-96 | Wall finish, coat of **Roll-on Wall Coating** 1.00 mm thick, including a base coat in any colour. | Sqm | 907 |
| 15-97 | Wall finish, coat of **Graffito Wall coating** 1.5 mm to 3.00 mm thick, in any colour, (straight and swirl). | Sqm | 710 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 15-98 | Wall finish, coat of **Venetian grain, Wall coating** 1.5 mm to 3.00 mm thick (straight and girth) in any colour. | Sqm | 752 |
| 15-99 | Wall Finish, **Spray coat (like Zola etc.) single colour,** complete all as specified. | Sqm | 348 |
| 15-100 | Same as item 15-99 but **multi-colour,** complete all as specified. | Sqm | 396 |
| 15-101 | **Surface preparation by using putty** on plastered wall or ceiling to form smooth base for distemper, plastic emulsion paint etc., all as specified. | Sqm | 59 |
| | **EPOXY PAINTING (POL TANKS)** | | |
| 15-102 | **Cleaning of fuel tank** including removal of settled material/fuel particles from inner surface all as specified. | Lit | 2 |
| 15-103 | **Abrasive / Sand Blasting of Fuel Tank** for new un-painted (un-corroded) steel surface all as specified. | Sqm | 779 |
| 15-104 | Same as item 15-103 but corroded un-painted steel surface. | Sqm | 1147 |
| 15-105 | Same as item 15-103 but previously painted (old work) steel surface. | Sqm | 1044 |
| 15-106 | **Primer coat** imported (USA or Europe) to steel surface buff or ivory colour, minimum 125 micron dry film thickness, complete as specified. | Sqm | 4028 |
| 15-107 | Finish coat imported (USA or Europe) to steel surface white colour, minimum 125 micron film thickness complete as specified. | Sqm | 1147 |

SECTION -16

# GLAZING

# RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| 11 | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION -16
# GLAZING

## SPECIFICATIONS

**16.0.** The work covered under this section consists of glazing plate / sheet, tempered glass and glass blocks etc.

## MATERIAL REQUIREMENTS

**16.1. Glazing.** All glass to be of the best quality of its respective kind, free from specks, bubbles and defects.

16.1.1. **Sheet glass.** It is upto 6.34 mm in thickness.

16.1.2. **Plate glass.** It is more than 6.34 mm in thickness.

16.1.3. **Glass.** To be plain, tempered, tinted, milky, rough, wired cast, rolled wire or ornamental rolled, s ordered.

16.1.4. **Glass Blocks.** To be plain or of different shapes and colour, generally used for ornamental and low lighting.

16.1.5. **Tempered Auto Sliding Glass.** 12 mm thick tempered auto sliding glass door with sliding and censor system

16.1.6. **Tempered Glass Door.** 12 mm thick open able tempered glass door having Aluminum frame (top & bottom ) with floor mounted pivot system

16.1.7. **Tempered Glass Partition Wall.** 10/12 mm thick tempered glass partition wall with aluminum / stainless steel frame.

16.1.8. **Tempered Glass for Roof Opening/ Sky Light.** Tempered glass with aluminum / steel frame for skylights and roof openings

## CONSTRUCTION REQUIREMENTS

**16.2. Glazing.** Rebates of frames of doors and windows etc, shall be provided with paint of same type as of doors and windows.

**16.3 Putty**

16.3.1. It shall be prepared by taking 930 grams, finely powdered whiting, 58 grams white lead (dry), 350 grams raw Linseed oil, 30 grams litharge, mixing well together and beating with a wooden mallet until thoroughly incorporated. If the putty becomes hard, it can be restored by heating it and working it up while hot.

16.3.2. Ready made putty can also be used, if approved by the Engineer-in-Charge.

**16.4. Fixing of Sheet Glass.** Where not otherwise specified, to be fixed in oil putty (Red lead putty for steel sashes) well bedded and back puttied, and the glass well springed, where necessary. All broken or damaged glass will be hacked out and replaced and on completion, the whole of the glazing is left perfect. Rebates, whether in new or old work to be painted one coat, before glazing, or moistened with raw linseed oil, if joinery is to be oiled. Each pan of glass to be in one whole piece, pieces of pans of glass will not be allowed.

**16.5. Fixing of Plate Glass.** To be fixed as per the recommendations of the Manufacturer, its purpose and requirements relate to the site. It shall be approved by the Engineer- in- Charge before execution of the work.

**16.6. Glass Blocks/ Tiles.** To be fixed as per the recommendations of the Manufacturer, and as approved by the Engineer-in-Charge before execution of the work.

## METHOD OF MEASUREMENTS

**16.7. Tolerance**

16.7.1. Take dimensions to nearest cm.

16.7.2. Measure irregular panes as the smallest circumscribing rectangle.

## CLARIFICATION OF RATES

**16.8.** The rates, inter alia, include particularly:-

(1) Glazing with springs and oil putty, well bedded and back puttied or beads, screws, as required in wood or metal sashes, skylights etc.

(2) All cutting and waste.

(3) Fixing in any position.

**ITEM RATES**

| Sl No. | Description | Unit | Rate (Rs)j |
|---|---|---|---|
| | **Glazing** | | |
| 16-1 | Supply and fix, **Plain Sheet glass 3 mm thick,** fixed to timber or steel sashes with putty as specified. | Sqm | 1123 |
| 16-2 | Same as item 16-1, but **5mm thick.** | Sqm | 1523 |
| 16-3 | Supply and fix, **Frosted Sheet glass 3 mm thick,** fixed to timber or steel sashes with putty as specified. | Sqm | 1294 |
| 16-4 | Same as item 16-3, but **5mm thick.** | Sqm | 1680 |
| 16-5 | Supply and fix, **Tinted Sheet glass 5 mm thick,** fixed to timber or steel sashes with putty as specified. | Sqm | 1680 |
| 16-6 | Supply and fix, **Milky glass 5 mm thick,** fixed to timber or steel sashes with putty as specified. | Sqm | 2094 |
| 16-7 | Supply and fix, **Plain Sheet glass 3 mm thick,** fixed to timber or steel sashes with hard /soft wood beads and screws as specified. | Sqm | 1208 |
| 16-8 | Same as Item 16-07, but **5mm thick.** | Sqm | 1608 |
| 16-9 | Supply and fix, **Plate glass 8 mm thick,** fixed to timber or steel sashes with Hard /Soft wood beads and screws as specified. | Sqm | 2666 |
| 16-10 | Same as Item 16-9, but **10 mm thick.** | Sqm | 3593 |
| 16-11 | Same as Item 16-9, but **12 mm thick.** | Sqm | 4405 |
| 16-12 | Supply and fix, **Frosted glass 3 mm thick,** fixed to timber or steel sashes with hard /soft wood beads and screws as specified. | Sqm | 1380 |
| 16-13 | Same as Item 16-12, but **5mm thick.** | Sqm | 1765 |
| 16-14 | Supply and fix, **Tinted glass 5 mm thick,** fixed to timber or steel sashes with hard/softwood beads and screws or by the use of rubber lining. | Sqm | 1765 |
| 16-15 | Same as item 16-14, but 8 mm **thick.** | Sqm | 4164 |
| 16-16 | Supply and fix, **Milky glass 5 mm thick,** fixed to timber or steel sashes with hard /soft wood beads and screws as specified. | Sqm | 2179 |
| 16-17 | Supply and fix, **Double Glazing glass 5 mm thick tinted,** fixed to timber or steel sashes with hard/ soft wood beads and screws or by use of rubber lining. | Sqm | 2436 |
| 16-18 | Supply and fix, **Re-inforced glass sheet 5 mm thick,** fixed to timber/ steel sashes with hard/ soft wood beeds and screws etc. | Sqm | 3839 |
| 16-19 | Supply and fix **Frosted paper of any design/ pattern** over plain glass complete, all as specified. | Sqm | 1595 |
| | **Hacking Out** | | |
| 16-20 | Hacking out old broken glass from sashes, remove any serviceable portions to store and dispose of rubbish. | Sqm | 473 |
| | **Tempering** | | |
| 16-21 | **Tempering** to any thickness of glass sheet, all as specified. | Sqm | 1949 |
| | **Glass Blocks** | | |
| 16-22 | Supply and fix, **Glass blocks,** size 190 mm x 190 mm x 80 mm, as specified. | Each | 665 |
| 16-23 | Same as item 16-22, but fixing only. | Each | 102 |
| 16-24 | Add to item 16-22 and 16-23, if fixed in repairs. | Each | 60 |

SECTION-17

# **SANITARY** FITTINGS

# RECORD OF **AMENDMENTS**

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-17

# SANITARY FITTINGS

## SPECIFICATIONS

**17.0.** Sanitary wares and fittings have been categorized into **Standard, Deluxe and Premium qualities** depending upon product specifications and quality. Common specifications enlisted in section 17.1.1 lays down the minimum essential requirements of all sanitary wares and fittings in order to qualify for use in MES works. The work covered under this section consists of all operations for Sanitary ware and fittings like Water Closets (WC), Wash-Hand Basins (WHB), basin mixer, wall showers, bath sets and accessories, including their specified jointing etc.

### 17.1. Common Specifications

17.1.1. **Sanitary Fittings.** All sanitary fittings must conform to following standards:

(1) Must be manufactured with dye casting machine.

(2) The profile should be screen printed.

(3) The spindle must be stamped (embossed) by the manufacturer.

(4) Brand name should be marked by laser itching.

(5) Faucets should be homogeneous, clean and cupric in colour (should not be porous and uneven).

(6) Where required, **Food Grade** grease and oil should be used in manufacturing process.

17.1.2. **Sanitary Ware.** All sanitary fittings must conform to following standards:

(1) All items and fittings to be resistant to chemical exposure.

(2) All items and fittings to be stain resistant

### 17.2. Particular Specifications

17.2.1. **Sanitary Fittings.** Particular specifications associated with each category of sanitary fittings are tabulated in Table 17.1:-

**TABLE 17.1**
**Essential specifications for Sanitary Fittings**

**TABLE 17.1**
**Essential specifications for Sanitary Fittings**

| S/No | Description | Standard | Deluxe | Premium | Testing Standard |
|---|---|---|---|---|---|
| 1 | Copper (Cu) Content | 56% | 58% | ≥ 60% | ASTME-1476-04,ASTM B-487, ASTM A-90 |
| | Zinc (Zn) Content | 34 – 40% | | | |
| | Impurities (Other metals) | 4% | 2% | <1% | |
| 2 | Chrome Plating (microns) | 4 Microns | 6-8 Microns | ≥ 8 Microns | |
| 3 | Pressure Test for no leakage | 2 BAR | 5 BAR | 7 BAR | |
| 4 | Cartridge | 20-30mm | 30-40mm | ≥40mm | |
| 5 | Minimum cycles of operations (for all mechanical parts, mechanisms and sealing etc) | 400,000 | 450,000 | 500,000 | |

17.2.2. **Sanitary Ware.** Particular specifications associated with each category of sanitary ware are tabulated in Table 17.2

**TABLE 17.2**
**Essential specifications for Sanitary Ware**

| S/No | Test Description | Standard | Deluxe | Premium | Testing Standard |
|---|---|---|---|---|---|
| 1 | Water Absorption | ≤ 4% | ≤ 2% | ≤ 1% | ASTM C-373, 424, 484, 650, 1278 & SASO-1024/1998 |
| 2 | Scratch Hardness (Moh's Scale, Max value=5) | ≤4 to ≤3 | ≤3 to ≤2 | ≤2 | |
| 3 | Thermal Shock (minimum cycles for **No Crack** condition) | 8 cycles | 10 cycles | 12 cycles | |

## MATERIAL REQUIREMENTS

**17.3. Workmanship and Materials.** The material and fittings shall be of the quality, as approved by the Engineer-in-Charge. Fittings shall be neat and conforming to approved quality. The materials shall be of the specified grade and best quality.

**17.4. Jointing and Packing Materials.** Lead shall be sound, free from inclusions and shall be of the best quality available in the market. The packing material shall be of pure jute, hemp or hempen yarn. The mortar used for caulking joints shall be 1:2 Cement-Sand mortar with minimum water added to just wet all particles of cement and sand i.e. dry mix.

**17.5. Rubber Cone Joint Cover.** Rubber cones to be 100-150 mm long with end dia as required, edges beaded. Rubber shall be 6mm thick.

**17.6. Rag Joint Cover.** It may consist of clean Linen, 50 mm wide.

**17.7. Traps (For Sinks, Baths etc).** To be of approved make.

## CONSTRUCTION REQUIREMENTS

**17.8. Workmanship and Materials.** The workmanship / labour used in preparatory work and fittings shall be neat and approved by the Engineer-in-Charge.

**17.9. Joints Generally.** These shall be made with special care, particularly joints between different materials. No joint to be embedded in a wall, if avoidable.

**17.10. Cement Caulked Joints.** The spigots to be packed and caulked to 13mm depth of tarred yarn or yarn impregnated in cement slurry. Pipe to be truly fitted concentric, to be solidly bedded, packed, caulked with wooden caulking tool, shaped to fit the angular ring, joined in cement mortar 1:1 and finished with a bold collar of cement mortar on the outside of each joint. The bore of the pipes to be care-fully wiped clean, as work proceeds.

**17.11. Run Lead Caulked Joints.** The spigot and socket are to be cleaned, truly fitted and concentrically aligned, the joint to be packed and caulked for half the depth of the socket with picked gaskit and then filled with molten lead, caulked and trimmed.

**17.12. Lead Wool Caulked Joint.** To be run lead using lead wool in lieu of molten lead.

**17.13. Lead Caulked-Joint.** The pipes to be clean, fitted, aligned, concentric, the joint packed and caulked with picked gasket, mixed with red lead putty. The joint be neatly finished with a bold collar of similar materials.

**17.14. Joint to Similar Materials**

17.14.1. Lead to lead, wiped lead joint.

17.14.2. Stoneware / Porcelain to stoneware-caulked cement joint.

17.14.3. Iron to iron

(1) Run lead caulked joint.

(2) Lead wool caulked joint.

**17.15. Joint to Dissimilar Materials**

17.15.1 **Lead to Stoneware etc.** Use 150 mm long, 5 mm thick brass ferrule one end plain, other flanged. Plain end to be wiped to lead and flanged end caulked with stoneware, by any one of the following:-

(1) Cement caulked into stoneware socket.

(2) Red lead caulked into stoneware socket.

(3) Finish with a rag cover.

17.15.2. **Stoneware to Lead.** Use a spigot and socket piece 150 mm long and 5 mm thick brass.

(1) Put brass socket into stoneware spigot and cement in the joint.

(2) Put lead pipe into brass socket and caulk the joint with cement.

(3) Provide rag cover.

17.15.3. **Lead to Iron.** Use a 5mm thick, 150mm long brass ferrule, with one flanged end and the other plain. Wipe the plain end of ferrule to the plain end of the lead and put the flanged end of ferrule to socketed end of CI pipe and caulk the run lead upto the flange of ferrule in the socket.

17.15.4. **Iron to Lead.** Use a brass spigot and socket piece of 5mm brass, 150 mm long.

(1) Run lead, caulk the iron spigot into the brass socket.

(2) Lead wool, caulk the Iron spigot into the brass socket.

(3) The spigot end of the brass to be wiped to the Lead.

17.15.5. **Stoneware, etc to Iron**

(1) Cement caulk the stoneware spigot into a special large socket of the iron pipe.

(2) Red lead caulk.

(3) Use a rag cover where directed.

17.15.6. **Iron to Stoneware**

(1} Cement caulk or Red lead caulk.

(2} Use a rag cover where directed.

**17.16. Rubber Cone Joint Cover.** Rubber cones to be 100mm to 150mm long with end dia as required and edges beaded. Rubber be 6mm thick and cone be bound with copper wire.

**17.17. Rag Joint Cover.** Shall be thickly coated with thick red lead paint and bandaged (six laps} round the joint. To be secured with copper wire and finished with 2 coats of Lead paint.

**17.18. Testing of Work.** Whole of the work shall be tested at the contractor's expense, to entire satisfaction of the Engineer-in-Charge. All defective items including leakages be rectified/ replaced.

## METHOD OF MEASUREMENTS

**17.19.** Measurements will be carried out as under:-

(1} Fitting shall be enumerated, except where otherwise described.

(2} The items shall be measured in units of each as enumerated for respective items.

(3} The dimensions shall be measured to the nearest mm.

## CLARIFICATION OF RATES

**17.20.** The rates, inter alia, include particularly:-

(1} **Fixing Only Rates**

(a} The rates for **"Fixing only"** Water Closets (WC} and urinals complete included for pedestal, pattern with loose trap and the rates including for securing to floors or wall, in cement mortar 1:3 and bedding traps of Asian WC. in PCC 1:2:4, also for securing seats, flushing cisterns to walls, fixing and jointing flush pipes including joints to fittings and for fixing stoppers, if anti syphonage pipes are not required.

(b} The rates for **"Fixing only"** sinks, basins in range included for properly securing to brackets or bedding in cement to dwarf piers, and fixing waste or overflow gratings and trap, stopper and chain. These rates also included for fixing only a porcelain stopper in lieu of a pillar cock, if only one pillar cock is required and supplied.

(2} The rates for **"Add if Fixed in Repairs"** including carriage to MES store or for safe custody until required to reuse, and making good on completion.

(3} All **"Fixing Only Rates"** including all jointing and fixing materials, i.e. lead wool, red lead, cement mortar, screws, nails and other subsidiary articles required for proper fixing of the fittings, but not include for red lead joints to iron or soldered joint to lead, service waste or over flow pipes, where required.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Water Closet (WC) and Urinals** | | |
| 17-1 | Supply and Fix **Water Closet (WC) of standard quality, European pattern** complete (coupled) all as specified. | Each | 13604 |
| 17-2 | Same as item 17-1 but **deluxe quality.** | Each | 16784 |
| 17-3 | Same as item 17-1 but **premium quality.** | Each | 22832 |
| 17-4 | Same as item 17-1 to 17-3, but fixing only | Each | 738 |
| 17-5 | Add to item 17-1 to 17-4, if fixed in repair. | Each | 382 |
| 17-6 | Supply and Fix, **Water Closet (WC) wall mounted** including fittings / fixtures complete all as specified. | Each | 16206 |
| 17-7 | Supply and Fix **Flush tank concealed type** complete all as specified. | Each | 21675 |
| 17-8 | Supply and Fix, **flushing cistern glazed,** complete all as specified, (for replacement/ maintenance only). | Each | 3677 |
| 17-9 | Supply and Fix, **Water Closet (WC), European pattern only,** complete all as specified, (for replacement/ maintenance only). | Each | 4813 |
| 17-10 | Supply and Fix, **WC Asiatic pattern not less than 550 mm with flushing system** complete all as specified. | Each | 6667 |
| 17-11 | Same as item 17-10, but fixing only. | Each | 738 |
| 17-12 | Add to item 17-10 and 17-11, if fixed in repair. | Each | 382 |
| 17-13 | Supply and fix, **Urinal** comprising basin, flushing cistern, flush pipe etc. complete all as specified. | Each | 6311 |
| 17-14 | Same as item 17-13, but fixing only. | Each | 912 |
| 17-15 | Add to item 17-13 and 17-14, if fixed in repair. | Each | 464 |
| 17-16 | Supply and fix1**Closet Pan only,** Asiatic pattern, including connection complete all as specified. | Each | 3955 |
| 17-17 | Same as item 17-16, but fixing only in repair. | Each | 872 |
| 17-18 | Supply and fix, **Low down plastic flushing cistern,** with connection to flushing pipe etc. complete all as specified. | Each | 2806 |
| 17-19 | Same as item 17-18, but fixing only. | Each | 366 |
| | **Sink Scullery** | | |
| 17-20 | Supply and fix, Sink Scullery of **Stainless Steel,** with **single drainage board,** shallow or deep upto 6000 sqcm, including all fixing, fittings, accessories etc. | Each | 8063 |
| 17-21 | Same as item 17-20 but with **double drainage board with single bowl** all as specified. | Each | 12011 |
| 17-22 | Same as item 17-20 but with **single drainage board, with double bowl** exceeding 6000 sqcm upto 7500 sqcm, &II as specified. | Each | 9692 |
| 17-23 | Same as item 17-20 but with **double drainage board** and **double bowl,** exceeding 6000 sqcm upto 9300 sqcm, all as specified. | Each | 14281 |
| 17-24 | Fixing only, of Sink Scullery, **single drainage board** and **single bowl,** including all fittings, accessories etc. | Each | 1603 |
| 17-25 | Add to item 17-24, for fix in repair. | Each | 464 |
| 17-26 | Fixing only of 17-24 but **double drainage board** and **single bowl,** all as specified. | Each | 1602 |
| 17-27 | Add to item 17-26, but if fixed in repairs. | Each | 464 |
| 17-28 | Fixing only of 7-23 but **double drainage board and double bowl,** all as specified. | Each | 1654 |
| 17-29 | Add to item 17-28, if fixed in repairs. | Each | 464 |
| 17-30 | Supply and fix, **Chromium Plated (CP) shower rose of any dia,** fixed or adjustable. | Each | 807 |
| 17-31 | Fixing only, Shower rose. | Each | 83 |

| SI No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 17-32 | Add to item 17-30, and 17-31, if fixed in repairs. | Each | 66 |
| | **Wash Hand Basin (WHB)** | | |
| 17-33 | Supply and Fix **Wash Hand Basin (WHB) of standard quality,** including pedestal, waste pipe, bolts/ bracket ana coupling etc., complete all as specified. | Each | 8278 |
| 17-34 | Same as item 17-33 but **deluxe quality.** | Each | 10462 |
| 17-35 | Same as item 17-33 but **premium quality.** | Each | 13444 |
| 17-36 | Fixing only, of WHB, including all fittings, except mixer and pedestal. | Each | 1059 |
| 17-37 | Fixing only, of WHB with Pedestal , including , all necessary fittings except | Each | 1059 |
| Mixer. 17-38 | Add to item 17-36 to 1*t-37*.if fixed in repr1 | Each | 464 |
| 17-39 | Supply and Fix, **wash hand Wash of any colour/ size except pedestal and mixer,** complete all as specified, (for replacement maintenance only). | Each | 4098 |
| 17-40 | Supply and Fix, **pedestal for wash hand basin in any colour,** complete all as specified, (for replacemenU maintenance only). | | |
| | **Mirrors** | | |
| 17-41 | Supply and fix , **Mirror**,,any shape and pattern, circular, rectangular, oval etc.) upto 2700 sqcm, 5 mm thick, with plastic frame of any colour edges ground, complete all as specified. | Each | 972 |
| 17-42 | Same as tern 17-41, but fixing only. | Each | 247 |
| 17-43 | Add to Item 17-41 and 17-42, if fixed in repair. | Each | 108 |
| 17-44 | Supply and fix, **Mirror,** (any shape and pattern), 5 mm thick, edges ground, complete all as specified. | Sqm | 1727 |
| 17-45 | Same as item 17-44, but fixing only. | Sqm | 460 |
| 17-46 | Same as item 17-44 and 17-45, if fixed in repair. | Sqm | 100 |
| | **Bath Accessories** | | |
| 17-47 | Supply and fix, **Plastic shelf.** in any size ::1nd shape, with plugs and screws, complete all as specified. | Each | 726 |
| 17-48 | Same as item 17-47, but fixing only. | Each | 139 |
| 17-49 | Same as item 17-47 and 17-48, if fixed in repair. | Each | 55 |
| 17-50 | Supply and fix, **Toilet paper holder,** any shape, pattern, size with plugs, screws etc., complete all as specified. | Each | 719 |
| 17-51 | Supply and fix, **Corner Shelf** in any size, shape with plugs and screw complete all as specified. | Each | 2054 |
| 17-52 | Supply and fix, **Soap / sponge tray** any shape, pattern and size with plugs, screws etc. complete all as specified. | Each | 497 |
| 17-53 | Same as item 17-52, but **Brush** holder. | Each | 642 |
| 17-54 | Same as item 17-52 to 17-53, out flxiny only. | Each | 122 |
| 17-55 | Add to item 17-52 to 17-54, if fixed in repairs | Each | 76 |
| 17-56 | Supply and fix, **Towel rail, CP, single rod,** any pattern, shape and size with plugs, screws etc. complete all as specified. | Each | 1399 |
| 17-57 | Same as item 17-56, but **double rod.** | Each | 1510 |
| 17-58 | Same as item 17-56 to 17-37. but fixing only. | Each | 203 |
| 17-59 | Same as item 17-56 to 17-58, if fixed in repairs. | Each | 108 |
| 17-60 | Supply and fix, **Plastic Bath cabinet,** 450 mm x 450 mm x 100 mm, complete all as specified. | Each | 3524 |
| 17-61 | Same as item 17-60, but fixing only. | Each | 203 |
| 17-62 | Supply and fix, **Bath curtain** (1.78 m x1.78 m) with plastic rings etc. complete all as specified. | Each | 1117 |
| 17-63 | Supply and fix, 100 mm dia **floor trap,** including reducer etc. complete all as specified. | Each | 2185 |
| 17-64 | Supply and fix, **Casted Grating CP,** 100 mm x 100 mm. | Each | 619 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 17-65 | Same as item 17-64, but 150 mm x150 mm. | Each | 813 |
| 17-66 | Supply and fix, **Bottle trap,** complete all as specified. | Each | 1675 |
| 17-67 | Supply and fix, **Plastic float valve,** for 15 mm dia pipe complete all as specified. | Each | 385 |
| 17-68 | Supply and fix, **Copper float valve,** for 20 mm dia pipe complete all as specified. | Each | 542 |
| 17-69 | Supply and fix, **Plastic connection** with brass, C.P or Aluminium union at both ends, 15mm dia from 300mm to 450mm. | Each | 135 |
| 17-70 | Same as item 17-69, but with **plastic union,** at both end. | Each | 252 |
| 17-71 | Same as item 17-69, but 20 mm dia. | Each | 252 |
| 17-72 | Supply and fix, **CP Copper connection,** with brass union on both ends, 20 mm dia upto 450 mm long. | Each | 542 |
| 17-73 | Supply and fix, **Vanity bowl,** glazed ware, one hole, with bottle trap, waste coupling etc. complete all as specified. (except mixer). | Each | 6307 |
| 17-74 | Same as item 17-73, but fixing only. | Each | 554 |
| 17-75 | Supply and fix, 25 mm thick, **marble slab** around vanity bowel, with brackets etc including cutting in any shape with machine, rubbing, polishing and making the joints water tight. | Sqm | 3177 |
| 17-76 | Supply and Fix, **Toilet shower,** 15 mm dia. | Each | 1493 |
| 17-77 | Fixing only, **Toilet shower,** 15 mm dia. | Each | 165 |
| 17-78 | Fixing only, **Wall shower** of any type. | Each | 330 |
| 17-79 | Supply and fix, **Seat cover.** | Each | 1532 |
| 17-80 | Supply and Fix, **Hydraulic seat cover.** | Each | 3378 |
| 17-81 | Supply and Fix **Accessories bath set plastic** consisting of shelf, towel rail, ring, brush holder, toilet paper holder, soap dish and mirror, complete as specified. | Each | 7162 |
| 17-82 | Same as item 17-81 but **CP,** complete as specified. | Each | 11962 |
| 17-83 | Fixing only **Accessories bath set** consisting of shelf, towel rail, ring, brush holder, toilet paper holder, soap dish and mirror, complete as specified. | Each | 1162 |

# SECTION-18

## WATER SUPPLY

## (PIPING PLUMBING AND ALLIED WORKS)

# RECORD OF **AMENDMENTS**

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION -18

# WATER SUPPLY

# PIPING, PLUMBING AND ALLIED WORKS

## SPECIFICATIONS

**18.0.0.** This section covers all operations for water supply work in two sub-sections as under:-

(1) **Sub-Section (18-1) - Piping Works and Fixtures.** It covers GI and MS pipes / fixtures (light, medium and steam quality), PRR and PE pipes/ fittings. All material shall comply with relevant and latest BS or equivalent Pakistan standard specifications.

(2) **Sub-Section (18-2) - Plumbing and Allied Works.** It includes all fittings for Water Supply, Plumber's Brass Work, provision and installation of allied works like water tanks, water cooler and filters etc. It also covers testing and disinfection of water.

## SUB-SECTION 18-1

## PIPING WORKS AND FIXTURES
## (GI, MS, PPR, PE etc)

### MATERIAL REQUIREMENTS

**18.1.1. Water Quality (Light/Medium) and Steam Quality (Medium) Tubing.** To be screwed and socketed in accordance with the latest addition of BS No.1387 as per Table 18-1-1, 18-1-2 and Table 18-1-3.

18.1.1.1. All black MS piping 1-1/2" and above shall be arranged with welded joints, providing flanges where necessary for easy dismantling. In particular flanged joints shall be provided for equipment, valves, strainers, expansion joints and other specialties.

18.1.1.2. All site welding shall be done by electric arc welding process with all joints 45° bevel type, pipe mill beveled or beveled at site by the Contractor, all scale and oxide shall be removed with hammer, chisel or file, bevel shall be smooth and lean before welding, two pipe ends to be lined straight and concentric.

18.1.1.3. Both conductors of welding machine shall be brought to the work location and shall be taped and held together to prevent induced currents in pipes, other metals and structural steel. The earthing lead shall be connected to pipe with suitable clamp in a manner so that welding current shall not flow through pipe joints, pipe supports or structural steel. Earthing lead shall not be spot welded to the pipe.

18.1.1.4. The weld metal shall be thoroughly fused with base metal at all points and the welds shall be of sound metal and free from slag or other defects.

18.1.1.5. All welders shall be fully qualified and approved for the work. If required their test certificates shall be submitted to the engineer for approval before the welders are allowed to work.

18.1.1.6. Where screwed joints are used, the screw threads shall be cut clean and true, screwed joints made tight with plastic tape. Red and white lead, pipe dope, caulking or filling compounds shall not be used. Reducing fittings shall be used to change pipe sizes and no bushings shall be used. All necessary unions shall be provided for easy dismantling.

18.1.1.7. All pipes shall be properly supported on clamps, hangers etc., of approved design. Supports shall be designed to permit from expansion and contraction to minimize vibrations. All supports for piping in the plant rooms, inspection passage and vertical risers shall be provided with rubber in shear or spring on combination or equal anti vibration supports to prevent transmission of vibrations to the building structure. No pipe shall be suspended from other pipes.

18.1.1.8. In general for horizontal M.S. piping, pipe supports shall not be more than 7ft, apart for pipes between 1" and smaller, 10ft for pipes between 1-1/2" to 3", 14ft for pipes between 4" to 6" and 17ft for pipes above 6". Supports shall be provided as near as possible to the valves, strainers, tees, other special fittings and equipment connections.

18.1.1.9. The horizontal piping hangers shall be supported from building steel framing or concrete inserts of sufficient strength.

18.1.1.10. All vertical pipes shall be supported by heavy clamps resting on the building structure

18.1.1.11. Hangers for insulated piping shall have broad contact areas so as not to damage insulation by load connection. The hangers shall also support insulated pipe without damaging the insulation.

18.1.1.12. During installation, adequate temporary supports shall be provided so that the piping is not supported by the equipment.

18.1.1.13. All pipe work shall be so arranged and assembled as to prevf>nt unaer strain or leakage caused by expansion and contraction. The riser branches shall be arrangerl to take up motion of risers and mains. The piping shall be anchored where required to localize expansion or to prevent undue strain or piping and branches. Anchors shall be of approved design, heavy welded construction and entirely separate from hangers.

18.1.1.14. Expansion joints shall be installed in the piping at building expansion points and where required at other locations to prevent undue stresses in the piping. Expansio,1 joints shall be hydraulically formed, pack less stainless steel bellows type, self-equalizing with external protection, internal sleeve and factory installed flanged connections. The joints shall have required traverse, temperature and pressure rating (minimum 100 psi). At least one set of guides shall be installed on either side of the joints. Where space is available, expansion loop shall be used instead of an expansion joint

18.1.1.15. All pipes passing through floors or walls shall have 20 gauge G.I sleeves to the full depth of the finished floor construction or thickness of the finished wall and extending ¼" beyond the finished face of the structure on both sides. The sleeves shall be of sufficient size to cover pipe insulation or any other pipe covering, and allow at least 1/8" clearance in sleeve for free movement of piping.

18.1 1.16. The pipe shall be properly graded to secure easy circulation and prevent noise and water hammering. Maximum possible pitch shall be allowed to the points where vents, relief, drip and drain connections are provided. Capped dirt pocket shall be provided at all riser bottoms, low points and other places where dirt and scale may accumulate. Generally the contractor should provide drain cocks at low points and automatic vents at high points. Drain cocks at low points shall have threaded ends fnr hose connection. Inverted ball-float straps shall be used for automatic venting of water mains at all high points and where ever else required. The vents shall be connected to the nearest drain point or the outlet piping so arranged that any water leakage does not cause any damage.

**TABLE 18-1-1**
**DIMENSIONS OF BLACK STEEL TUBES (LIGHT QUALITY)**

| Nominal Dia {mm) | Gauge | Wall thickness {mm) | Weight of black tube | |
|---|---|---|---|---|
| | | | Plain end (Kg/ M) | Threaded and Socketed (Kg/ M) |
| 15 | 14 | 2.0 | 0.952 | 0.961 |
| 20 | 13 | 2.35 | 1.41 | 1.42 |
| 25 | 12 | 2.65 | 2.01 | 2.03 |
| 32 | 12 | 2.65 | 2.58 | 2.61 |
| 40 | 11 | 2.90 | 3.25 | 3.29 |
| 50 | 11 | 2.90 | 4.11 | 4.18 |
| 65 | 10 | 3.25 | 5.80 | 5.92 |
| 80 | 10 | 3.25 | 6.81 | 6.98 |
| 100 | 9 | 3.65 | 9.89 | 10.20 |

**TABLE 18-1-2**
**DIMENSIONS OF STEEL TUBES - (MEDIUM QUALITY)**
FOR WATER SUPPLY/ STEAM/ SUI-GAS

| Nominal Dia mm | Gauge | Wall thickness mm | Weight of black tube | |
|---|---|---|---|---|
| | | | Plain End KG/M | Screwed & Socketed Kg/M |
| 15 | 12 | 2.65 | 1.22 | 1.23 |
| 20 | 12 | 2.65 | 1.58 | 1.59 |
| 25 | 10 | 3.25 | 2.44 | 2.46 |
| 32 | 10 | 3.25 | 3.14 | 3.17 |
| 40 | 10 | 3.25 | 3.61 | 3.65 |
| 50 | 9 | 3.65 | 5.10 | 5.17 |
| 65 | 9 | 3.65 | 6.51 | 6.63 |
| 80 | 8 | 4.05 | 8.47 | 8.64 |
| 100 | 7 | 4.50 | 12.10 | 12.40 |
| 150 | 6 | 4.85 | 19.20 | 19.80 |

**Note:-** Tolerance in Thickness and Weight ±5%.

**TABLE 18-1-3**
**SCH-40 PIPE : Product Range-Sch 40**

| Nominal Dia | | Outer Dia | | | | Wall Thickness | | Standard Black Pipe Weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | | Min | | | | | | |
| mm | Inches | mm | Inches | mm | Inches | mm | Inches | Lb/ft | Kg/Mtr | Mtr/Ton |
| 15 | ½" | 21.70 | 0.854 | 20.90 | 0.823 | 2.77 | 0.109 | 0.85 | 1.27 | 790 |
| 20 | ¾" | 27.10 | 1.067 | 26.30 | 1.035 | 2.87 | 0.113 | 1.13 | 1.69 | 593 |
| 25 | 1" | 33.80 | 1.331 | 33 | 1.299 | 3.38 | 0.133 | 1.68 | 2.50 | 400 |
| 32 | 1 ¼" | 42.60 | 1.677 | 41.80 | 1.645 | 3.56 | 0.14 | 2.27 | 3.39 | 295 |
| 40 | 1 ½" | 48.70 | 1.917 | 47.90 | 1.886 | 3.68 | 0.145 | 2.72 | 4.05 | 247 |
| 50 | 2" | 69.90 | 2.398 | 59.70 | 2.35 | 3.91 | 0.154 | 3.66 | 5.44 | 184 |
| 65 | 2 ½" | 73.70 | 2.902 | 72.30 | 2.846 | 5.16 | 0.203 | 5.80 | 8.63 | 116 |
| 80 | 3" | 89.80 | 3.535 | 88 | 3.465 | 5.49 | 0.216 | 7.58 | 11.29 | 89 |
| 90 | 3 ½" | 102.60 | 4.039 | 100.60 | 3.961 | 5.74 | 0.226 | 9.12 | 13.57 | 74 |
| 100 | 4" | 115.40 | 4.543 | 113.20 | 4.457 | 6.02 | 0.237 | 10.80 | 16.07 | 62 |
| 125 | 5" | 142.70 | 5.618 | 139.90 | 5.508 | 6.55 | 0.258 | 14.63 | 21.77 | 46 |
| 150 | 6" | 170 | 6.693 | 166.60 | 6.559 | 7.11 | 0.280 | 18.99 | 28.26 | 35 |
| 200 | 8" | 221.3 | 8.712 | 216.9 | 8.539 | 8.18 | 0.322 | 28.59 | 42.55 | 23 |
| 250 | 10" | 275.7 | 10.855 | 270.3 | 10.64 | 9.27 | 0.364 | 40.51 | 60.29 | 16 |
| 300 | 12" | 327 | 12.874 | 320.6 | 12.62 | 10.31 | 0.405 | 53.55 | 79.70 | 12 |

**18.1.2. Steel Tubing for External Water Supply (Heavy).** To be Flanged/Socketed in accordance with API-5L (Grade-B) as in Table 18-1-4:-

**TABLE 18-1-4**
**DIMENSIONS OF STEEL TUBES - (HEAVY)**

| Nominal Dia mm | Wall thickness mm | Weight Plain end Kg/M | Test Pressure Kg/Sq. cm. |
|---|---|---|---|
| 200 | 4.80 | 25.37 | 63 |
| -do- | 6.40 | 33.57 | 84 |
| 250 | 4.80 | 31.76 | 50 |
| -do- | 6.40 | 42.09 | 68 |
| 300 | 6.40 | 50.11 | 56 |
| -do- | 7.10 | 55.47 | 64 |

**18.1.3. Fittings.** All fittings used for Water Supply shall be of the pattern and standards conforming to the regulations. The specifications are given in Section 18-2 (Refer to Para.18.2.1).

18.1.3.1. The drain cocks/vents at inlet/outlet connections of each equipment, cooling and heating coils.

18.1.3.2. All elbows shall be long radius type except where space limitation necessitates use of short radius type.

18.1.3.3. All stop valves, check valves, drain cocks, dirt traps, automatic vents, manual vents, pressure gauge, strainers and other specialties as required for proper operation of the whole system.

18.1.3.4. All cast iron body valves shall have renewable bronze seat rings, bronze spindles and to have self-packing feature so that they can be packed while open and under pressure. The valves in the plant rooms which are more than 6 ft above the floor level shall be provided with chain operated sheaves and chains. Valves 1-1/2" and above should be with flanged bodies except for drain piping where screwed end valves may be used with unions for easy dismantling.

18.1.3.5. Check valves in horizontal position shall be 15° swing check and in vertical position balanced check valves of low pressure drop type.

18.1.3.6. The strainer shall be provided in the inlet connection of each automatic control valves, pressure reducing valves, pump suction, steam trap, make up water connection etc.

18.1.3.7. All strainers in water line shall be of "Y" pattern, preferably installed in horizontal, alternatively in vertical downward length of pipe. The strainers shall be arranged not to trap piping and allow easy disconnection for cleaning. The strainers shall have cast iron or bronze bodies able to withstand the working pressure, removable screens of copper, brass, nickel or stainless steel, flanged bodies with tapings for size 1-1/2" and above, and of such a design as to allow blowing out of accumulated dirt and easy removal and replacement of strainer screen without disconnecting the main piping.

18.1.3.8. All buried piping and weather exposed M.S. piping shall be protected with a jacket of 45 lbs roofing felt, all joints seals with hot bitumen PBS PB4 or approved equal and the entire surface given two heavy coats of cold bitumen PBS cold sticker or approved equal. In case of weather exposed piping, the jacket shall be further mechanically secured to the piping with ¾" wide soft aluminum bends generally spaced at 18".

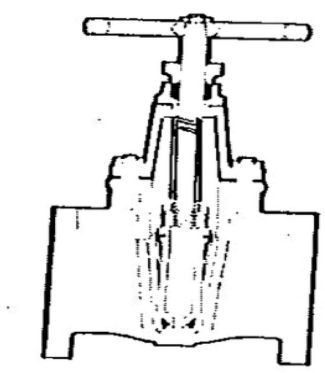
18.1.3.9. At the time complete plant is operated and tested piping system do not have rapid and noiseless circulation due to trapped or air bound connections or any other reason of defective installation and workmanship, the contractor shall be made responsible to make proper alterations in these defective connections.

### 18.1.4. Sluice valves

18.1.4.1. **Non Rising Steam Gate Valve as per BSS-3464**

**TABLE 18-1- 5**
**Materials used for Main Parts of Sluice Valve**

| Name of Parts | Material |
|---|---|
| Body, Gate, Bonnet | Gray Cast Iron |
| Gland, Hand wheel | Gray Cast Iron |
| Body Seats | Stainless Steel |
| Gate Seats | Stainless Steel |
| Stem (Spindle) | Stainless Steel |
| Stem Nut | Bronze |
| Bonnet Gasket | Synthetic Rubber/ Compressed Asbestos Fiber Jointing |
| Gland Packing | Lubricated Asbestos |



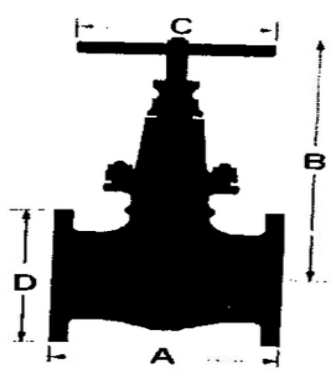


**TABLE 18-1-6**
**Dimension - Inch (mm)**
**(as per BSS-3464)**

| Size | | A | | B | | C | | D | | Weight in Kg |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | In | mm | In | Mm | In | mm | In | mm | In | |
| 50 | 2" | 145 | 5¾" | 270 | 10¾" | 150 | 6" | 150 | 6" | 17 |
| 65 | 2½" | 160 | 6¼" | 290 | 11 ½" | 150 | 6" | 165 | 6½" | 18 |
| 80 | **3"** | 165 | 6½" | 330 | 13" | 225 | **9"** | 180 | 7¼" | 23 |
| 100 | **4"** | 170 | 6¾" | 390 | 15¼" | 250 | 10" | 215 | 8½" | **28** |
| 150 | **6"** | 210 | 8¼" | 460 | 18[1]/a" | 280 | 11 ½" | 275 | **11"** | **46** |
| 200 | **8"** | **240** | 9½" | 585 | 231/a" | 375 | 15" | 335 | 13 ¼" | 90 |
| 250 | 10" | 270 | 10 ¾" | 710 | 28" | 375 | 15" | 400 | 16" | 123 |
| 300 | **12"** | 300 | 12" | 805 | 31 ¾" | 525 | 21" | 450 | 18" | 174 |

**Note:-**

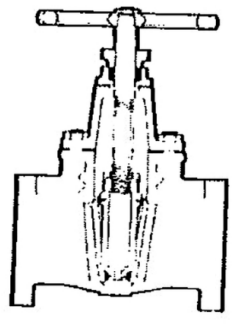
(1) Safe working pressure 200 psi.

(2) Tolerance on weights is plus/ minus 12 ½ %.

**TABLE 18-1-7**
**Service Rating**

| | | |
|---|---|---|
| Testing Pressure | Seat | 200 Psi |
| | Body | 250 Psi |
| Working Pressure | | 150 Psi |

18.1.4.2. **Non Rising Steam Gate Valve as per BSS--5163 / BSS-5150**



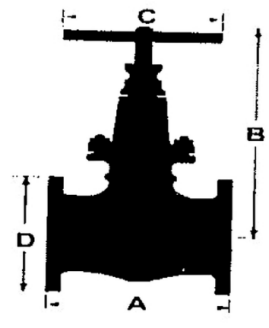


TABLE 18-1-8
Dimension - Inch (mm)
(as per BSS-5163 / BSS-5150)

| Size | | A | B | C | D (PN-10) | D (PN-16) | Weight in Kg |
|---|---|---|---|---|---|---|---|
| mm | In | mm | Mm | mm | mm | mm | |
| 80 | 3" | 203 | 411 | 200 | 200 | 200 | 27 |
| 100 | 4" | 229 | 432 | 250 | 220 | 220 | 37 |
| 150 | 6" | 267 | 518 | 250 | 285 | 285 | 59 |
| 200 | 8" | 292 | 615 | 300 | 340 | 340 | 107 |
| 250 | 10" | 330 | 710 | 400 | 395 | 405 | 165 |
| 300 | 12" | 456 | 789 | 400 | 445 | 460 | 215 |

**Note:-**

(1) Safe working pressure 200 psi. ,.

(2) Tolerance on weights is plus/ minus 12 ½ %.

**TABLE 18-1-9**
**Service Rating**

| Nominal Pressure (PN) ( Bar) | | 10 | 16 |
|---|---|---|---|
| Testing Pressure | Strength | 15 | 24 |
| | Sealing | 15 | 24 |

**18.1.5. Water Meters:-** Water meters upto 65 mm dia will be completed with union joints to suit GI / MS pipes. Those exc 65 mm dia will be of flanged ends & drilled as per BS Table 18-1-10.

**BS TABLE 18-1-10**
**STANDARD PIPE FLANGES**
**Overall Size and** Drilling **Dimensions**

| **Size of pipe** mm | **Overall** dia of **flange** (mm) | **Pitch circle dia(mm)** | **Number of bolts** | **Dia of holes mm** |
|---|---|---|---|---|
| 25 | 115 | 90 | 4 | 14 |
| 40 | 140 | 100 | 4 | 14 |
| 50 | 150 | 115 | 4 | 17 |
| 65 | 165 | 127 | 4 | 17 |
| 80 | 190 | 146 | 4 | 17 |
| 100 | 215 | 178 | 4 | 17 |
| 150 | 280 | 235 | 8 | 17 |
| 200 | 340 | 292 | 8 | 17 |
| 250 | 406 | 356 | 8 | 22 |
| 300 | 460 | 406 | 12 | 22 |

**Note:-**

(1) All tubing over 150 mm (6") dia shall conform to API-5L Grade-"B" standards.

(2) In case of galvanized pipes, the weight shall increase @ 0.61 Kg/Sqm of girthed area.

(3) Steam tubing to be capable of withstanding 35 Kg/Sqcm and water tubing28 Kg/Sqcm hydraulic pressure.

## CONSTRUCTION REQUIREMENTS

### 18.1.6. Sluice valves and Hydrants etc

18.1.6.1. Sluice valves and hydrants shall be flanged and drilled to BS given in Table 18-1-10.

18.1.6.2. All sluice valves and hydrants shall be housed in suitable brick masonry or PCC pits with pre-cast removable RCC / hinged steel covers with locking arrangement.

**18.1.7. Tubing.** All tubing (unless galvanized) will be coated with rust preventive coating before incorporation in work. Water quality tubing shall be painted 'Blue' and steam quality 'Red'.

18.1.7.1. All screwed connection to be taper threaded and put together with White lead and fine spun yarn.

18.1.7.2. The whole of the pipes and fittings to be fully tested and left drop dry on completion and put to commission.

18.1.7.3. MS Tubes 40 mm dia (and over) may be Butt welded.

18.1.7.4. The contractor while quoting rates shall include work both below and above ground, as specified 8r ordered.

18.1.7.5. In areas with high corrosive effect of moisture and minerals, coating and wrapping the exterior surface of MS pipe shall be carried out. Pipes shall first be thoroughly cleaned of all oil, grease, dirt, rust, moisture, or any other foreign substance. As far as practicable, immediately after cleaning, pipe surface shall be covered with bituminous primer leaving about 75 mm from either end. Primer should be applied after ascertaining that pipe surface to be covered is thoroughly dry and clean, as primer will not stick to wet and dirty surfaces. Primer shall be applied in thin layer and the pipe then wrapped all around with bitumen paper duly dipped in bitumen solution with an over-lap of single layer for pipes up to 100 mm dia. For pipes exceeding 100 mm dia double layer of bitumen paper shall be wrapped.

## METHOD OF MEASUREMENTS

**18.1.8.** Pipe work generally shall be measured Net overall length of pipes including fittings as fixed, except where otherwise described.

## CLARIFICATION OF RATES

**18.1.9.** The rates inter alias, include particularly:-

(1) Fixing complete in long or short lengths, (surface/ concealed), including running joints in length and use of white lead, yarn or rubber ring and bolts etc.

(2) Fixing of water tubing:-

(a) Fixing to wall complete with clips, wall hooks, clamps wooden / Rawal plugs.

(b) Making good surface disturbed.

(c) Forming all necessary holes and making good.

(d) The supply and fixing of all beddings, jointing pointing materials and reinforcement as required.

(3) Cuts in new water mains.

(4) For plumbing generally:-

(a) Jointing and fixing with and including supporting materials specified or necessary. Rates except pipes including for plugging walls, where required. Making good, provision and fixing of wall hooks, holder bats, clips, etc.

(b) Turning water On or Off as necessary.

(c) Taps, valves and other plumber's brass work with suitable washer complete.

(d) Jointing as specified or required.

(e} Taking off and re-fixing (stop cock, tank, manhole etc) covers for inspection, measuring, etc.

### 18.1.10. Poly Propylene Random (PPR) Pipe and Fixtures

## MATERIAL REQUIREMENTS

18.1.10.1. The Pipes and fixtures are both manufactured with same material, i.e. Poly Propylene Random (PPR). It is a food grade material with high chemical and heat / temperature (both hot and cold} resistance, due to which it is used as a popular means of supply for hot and cold water as well as other fluids.

18.1.10.2. PPR products are available in the market with various brand names, but the product must fulfill following specifications:-

| | | |
|---|---|---|
| (a) | Pipes | DIN 8077, 8078 |
| (b) | Fittings | DIN 16962 |

18.1.10.3. **Sizes of Pipes and Fittings.** The product is available in various sizes according to the purpose of use. However, the sizes given in Table 18-1-11 are being commonly used and marketed.

18.1.10.3.1 These pipes may be faulting and subsequently results in leakage / breakage and have less shelve life due to non-compliance of international standard.

_18.1.10.3.2 Normally for water supply pipes, PPRC pipe PN-20 and PN-25 is recommended according to the pressure and temperature (Refer Table 18-1-12).

18.1.10.3.3 PPRC pipe and fittings should be used for same approved brand / manufacturer.

18.1.10.3.4 Skilled manpower must be arranged for proper fittings and joints.

**TABLE 18 -1-11**
**SIZES OF PPR PIPES**

| Outer Dia d (mm) | Wall Thickness t (mm) | Internal Dia d1(mm) |
|---|---|---|
| 20 | 3.4 | 13.2 |
| 25 | 4.2 | 16.6 |
| 32 | 5.4 | 21.2 |
| 40 | 6.7 | 26.6 |
| 50 | 8.4 | 33.2 |
| 63 | 10.5 | 42.0 |
| 75 | 12.5 | 50.0 |
| 90 | 15.0 | 60.0 |
| 110 | 18.4 | 73.2 |

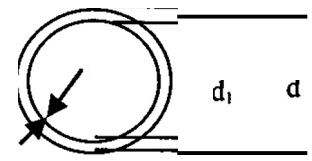



**TABLE 18-1-12**
**LIFE AND WORKING PRESSURE FOR TEMPERATURE OF PPR PIPE PN-20**

| Years | 20°c BARS | 30°c BARS | 40°c BARS | 50°c BARS | 60°c BARS | *10°c* BARS | 80°C BARS |
|---|---|---|---|---|---|---|---|
| 1 | 30.7 | 25.6 | 22.1 | 18.9 | 16.5 | 13.3 | 8.5 |
| 5 | 28 | 24 | 22.1 | 17.9 | 15.2 | 12.0 | 12.3 |
| 10 | 27.1 | 23.5 | 20.3 | 17.3 | 14.4 | 10.7 | 10.7 |
| 25 | 26.4 | 22.7 | 19.5 | 16 | 12.3 | 9.1 | 9.3 |
| 50 | 25.9 | 22.1 | 18.4 | 14.7 | 10.9 | 8.8 | 7.5 |

## CONSTRUCTION REQUIREMENTS

18.1.10.4. **Jointing Technique.** The jointing of PPR Pipes is carried out by a method called "Heat Fusion". It is done with an Electro fusion machine. The male and female ends / parts are joined together through heat to form a joint. Both the ends (Male & Female) are heated simultaneously till the welding temperature is reached. The two parts to be joined (now in molten state) are pressed together and held till recommended cooling time (given in Table 18-1-13). On cooling, a leak-proof permanent joint is formed which is irreversible. In case of bad jointing, the fitting is lost/ not reusable. The jointing shall be done strictly in accordance with manufacturer's instructions.

**TABLE 18-1-13**
**JOINTING BY FUSION METHOD -DATA**

| OUTER DIA | AVERAGE HEATING TIME | AVERAGE WORKING TIME (max) | AVERAGE COOLING TIME (min) |
|---|---|---|---|
| mm | sec | sec | sec |
| 20 | 5 | 4 | 2 |
| 25 | 7 | 4 | 2 |
| 32 | 8 | 6 | 4 |
| 40 | 12 | 6 | 4 |
| 50 | 18 | 6 | 4 |
| 63 | 24 | 8 | 6 |
| 75 | 30 | 8 | 6 |
| 90 | 40 | 8 | 6 |
| 110 | 50 | 10 | 8 |

18.1.10.5. The product be installed / fixed and used strictly in accordance with the instructions of the manufacturer duly approved by the Engineer in Charge.

## METHOD OF MEASUREMENTS

18.1.10.6. Pipe work generally shall be measured:-

(1) Net overall length of pipes and fitting as fixed, except, where otherwise indicated.

(2) Fitting shall be enumerated and described as extra over "pipes and fitting" except where otherwise indicated. ,-

## CLARIFICATION OF RATES

18.1.10.7. Rates (material and labour) calculated per metre of PPR pipes including the following:-

(1) Cost of one pipe of 4 M length (Class PN-20).

(2) Cost of fittings, "socket, bend, elbow etc" at the basis of average.

(3) Fixing charges for (1) and (2) above, with walls, open or concealed.

(4) Making good surfaces disturbed.

### 18.1.11. Poly Ethylene (PE) Pipes / Fixtures

**MATERIAL REQUIREMENTS**

18.1.11.1. The pipes and fixtures are both made with Poly Ethylene Compound. It is food grade material and being used for supply and distribution of water, compressed air and various chemicals due to its flexibility and other properties.

18.1.11.2. The PE pipes and fittings for water supply must conform to DIN 8074 / 8075 and PS - 3580.

18.1.11.3. The product is generally available in coils upto 50 M and 100 M length for sizes upto 90 mm, and for sizes above 90 mm dia in lengths of 6 M and 12 M. The commonly available sizes and dimensions are given in Table 18-1-14:-

**TABLE 18-1-14**
**POLYETHYLENE PIPE (PE 100) DIMENSIONS (ISO 4427, 2007)**

| Nominal Outsidedia (mm) | Nominal wall thickness ( mm) | | |
|---|---|---|---|
| | SDR 17 (PN 10) | SDR 13.6 (PN 12.5) | SDR11 (PN 16) |
| 20 | 1.9 | 1.9 | 2.0 |
| 25 | 1.9 | 2.0 | 2.3 |
| 32 | 2.0 | 2.4 | 3.0 |
| 40 | 2.4 | 3.0 | 3.7 |
| 50 | 3.0 | 3.7 | 4.6 |
| 63 | 3.8 | 4.7 | 5.8 |
| 75 | 4.5 | 5.6 | 6.8 |
| 90 | 5.4 | 6.7 | 8.2 |
| 110 | 6.0 | 8.1 | 10.0 |
| 125 | 7.4 | 9.2 | 4.0 |
| 160 | 9.5 | 11.8 | 14.6 |
| 180 | 10.7 | 13.3 | 16.4 |
| 200 | 11.9 | 14.7 | 18.3 |
| 250 | 14.8 | 18.4 | 22.7 |
| 280 | 16.6 | 20.6 | 25.4 |
| 315 | 18.7 | 23.2 | 28.6 |
| 355 | 21.1 | 26.1 | 32.2 |
| 400 | 23.7 | 29.4 | 36.3 |
| 450 | 26.7 | 33.1 | 40.9 |

The nominal pressure PN corresponds to the max allowable pressure in bars for pipe at 20° C.

18.1.11.4. The operating pressure ranges between 6 to 16 bar at 20° C, for various sizes and jointing types.

**CONSTRUCTION REQUIREMENTS**

18.1.11.5. The PE pipes and fittings shall be used and fixed in accordance with the manufacturer's instructions and approval of Engineer-in-Charge.

18.1.11.6. **Jointing Technique.** The PE pipes and fittings can be joined together by employing any of following techniques:-

(1) **Compression Fitting.** It is a mechanical technique. In this type of jointing a standard fitting is provided which is assembled with the help of clinching rings, 'O' rings and a locking nut. Necessary details are available with the fitting, which shall be strictly followed.

(2) **Butt Fusion.** It is a technique in which the two pipe ends or a pipe and fitting ends are heated to a molten state and brought together to form a homogeneous bond. It must be ensured that the material and size of both jointing ends are same dia (SOR, polymer etc). The process is done with the help of Butt Fusion equipment. The elaboration of Jointing Technique shall be provided by the manufacturer/ supplier.

**METHOD OF MEASUREMENTS**

18.1.11.7. Pipe work generally shall be measured:-

(1) Net overall length of pipes and fitting as fixed, except, where otherwise indicated.

(2) Fitting shall be enumerated and described as extra over "Pipes and fittings", except where otherwise indicated.

(3) For PE pipes with size 100 to 450 mm dia the fitting shall be enumerated and described as extra over "Pipes and fittings" and "Fusion joint", except where otherwise indicated.

18.1.11.8. **Back-Filling**

18.1.11.8.1. After pressure testing, filling of the trench is to be done in layer of 0.30 M over the pipe, utilizing stone free soil. The soil layer immediately over the pipe is to be compacted by tamping bars.

18.1.12.8.2. The material used for upper layers can be coarser than used for the initial back fill. These layers should be carefully rammed down one on top of the other until the back fill is completed.

## CLARIFICATION OF RATES

18.1.11.9. Rates (material and labour) calculated per metre of PE pipes including the following:-

(1) For dia 20 mm to 90 mm (Suckered joint).
   (a) Cost of 50 M length (Class PN-10).
   (b) Cost of one socket for each 50 M.
   (c) Fixing charges of (a) and (b) above.

(2) For dia 110 mm to 450 mm (butt Fusion / Electro fusion joint)
   (a) Cost of one pipe of 12 M length.
   (b) Cost of Fusion joint.
   (c) Fixing charges of (a) and (b) above.

## SUB-SECTION 18-2

## PLUMBING AND ALLIED WORKS

## MATERIAL REQUIREMENTS

**18.2.1. Fittings for Water Supply.** All bib cocks, stop cocks, etc. shall be of the pattern required to conform to the regulations and product of manufacturers included in the approved list of Engineer-in-Chief.

**18.2.2. Washers.** For ball/float valves, washers shall be manufactured of best quality rubber, and washers of water bib cocks and stop cocks shall be of leather, and that of hot water cocks shall be of vulcanized rubber.

**18.2.3. Plumber's Brass Work**

18.2.3.1. The whole of the plumber's brass work, copper or gunmetal fittings to be heavy quality and of approved manufactures to be fixed complete including any necessary subsidiary materials.

18.2.3.2. Bib, pillar and stop cocks (brass or gun-metal as ordered) to be for working pressures up to 14 Kg/Sq cm and will conform to BS-1010, or equivalent specifications.

18.2.3.3. Jumpers/washers are interchangeable i.e. to British Standard Dimensions. Sanitary fittings are screwed to BSP (British Standard Pipe and threads). Cocks to have stuffing boxes, loose valves and strong crutch handles lettered **"Hot" or "Cold"** for use with sanitary fittings, valves to be faced with specially prepared leather for cold water, and with good quality vulcanized rubber for hot water.

18.2.3.4. Pillar cocks as described in 18.2.3.2. but fitted with fancy head handles lettered **"Hot" or "Cold"** have long screwed shanks with fly nuts.

18.2.3.5. Ball valves shall be of strong brass of approved pattern with copper ball having screwed sockets. The valves to be faced with vulcanized rubber. Ball valve with plastic balls may also be used up to 25 mm dia.

18.2.3.6. Ferrules, unions, etc. shall be of heavy brass of approved quality, and when connected to lead pipes, shall have tinned ends.

18.2.3.7. Gunmetal may be used in lieu of brass at no extra price.

**18.2.4. Hard Brass.** Hard brass shall be a composition of Copper and Zinc with or without Lead or Tin, not less than 62% by weight of the composition being Copper and having tensile strength not less than 2 Ton/ Sqcm.

**18.2.5. Gunmetal.** As per BS EN1982, the Gunmetal shall be an alloy containing not less than 88% by weight of Copper, and not less than 10% by weight of Tin and the balance of 2% made up of by Zinc, Lead or Spalter and having a tensile strength of not less than 2.20 Ton/ Sqcm of sectional area. Elongation on 50 mm (2") shall be 15-25% and Brinell Hardness 70-95%.

**18.2.6. Water Tanks.** Quality standardized by E-in-C Branch.

**18.2.7. Water Coolers.** Quality approved by E-in-C Branch.

**18.2.8. Water Filters.** Quality standardized by E-in-C Branch.

**18.2.9. Disinfection for Water Supply.** After the completion of test (working pressure/leakage) of water mains satisfactorily and approved by the Engineer-in-Charge, the contractor shall disinfect the entire pipe network by means of dispensed solution of chlorine and water at minimum chlorine content 50 mg/ltr, for a period of 30 minutes. The procedure and equipment used to introduce, disperse and test Chlorine in pipes shall be subject to the approval of the Engineer-in-Charge.

**18.2.10. Testing**

18.2.10.1. All water mains and connections will be fully tested to 1½ times working pressure and left drop dry before hunching or trenches are filled in and put into commission.

18.2.10.2. The whole of the work is to be tested at the contractor's expense, to the entire satisfaction of Engineer-in-Charge.

18.2.10.3. **Plumber's Brass work**

(1) The rates for articles described as "Supplied and Fixed" including making all necessary joints.

(2) If stopcocks are ordered to be fitted with strong square-ended spindles to suit turn cock's key, the same rate as for clutch handles is to be allowed.

## ITEM RATES

| Sl No. | Description | Unit | Rate(Rs) j |
|---|---|---|---|
| | **Water Tubing - GI / MS** | | |
| 18-1 | **Tube, Water Quality (GI)** with all fittings (i.e sockets, bends, tees, elbows where required) and laid complete in trenches, (excluding excavation) or fixed to wall, floor (surface or concealed) and ceiling etc, including caps and plugs as required 15mm dia **(light),** supply and fixing. | Metre | 440 |
| 18-2 | Same as item 18-1, but 20 mm dia. | Metre | 585 |
| 18-3 | Same as item 18-1, but 25 mm dia. | Metre | 614 |
| 18-4 | Same as item 18-1, but 32 mm dia. | Metre | 732 |
| 18-5 | Same as item 18-1, but 40 mm dia. | Metre | 933 |
| 18-6 | Same as item 18-1, but 50 mm dia. | Metre | 1173 |
| 18-7 | Same as item 18-1, but 65 mm dia. | Metre | 1590 |
| 18-8 | Same as item 18-1, but 80 mm dia. | Metre | 1898 |
| 18-9 | Same as item 18-1, but 100 mm dia. | Metre | 2498 |
| 18-10 | **Tube, Water Quality (GI)** with all fittings (i.e. sockets, bends, tees, elbows where required) and laid complete in trenches (excluding excavation) or fixed to wall, floor (surface or concealed) and ceiling etc., including caps and plugs as required 15mm dia **(medium},** supply and fixing. | Metre | 485 |
| 18-11 | Same as item 18-10, but 20 mm dia. | Metre | 613 |
| 18-12 | Same as item 18-10, but 25 mm dia. | Metre | 697 |
| 18-13 | Same as item 18-10, but 32 mm dia. | Metre | 863 |
| 18-14 | Same as item 18-10, but 40 mm dia. | Metre | 980 |
| 18-15 | Same as item 18-10, but 50 mm dia. | Metre | 1407 |
| 18-16 | Same as item 18-10, but 65 mm dia. | Metre | 1696 |
| 18-17 | Same as item 18-10, but 80 mm dia. | Metre | 2215 |
| 18-18 | Same as item 18-10, but 100 mm dia. | Metre | 3195 |
| 18-19 | Same as item 18-10, but 150 mm dia. | Metre | 5454 |
| 18-20 | Same as item, 18-1 or 18-10, but fixing only. | Metre | 114 |
| 18-21 | Same as item, 18-2 or 18-11, but fixing only. | Metre | 114 |
| 18-22 | Same as item, 18-3 or 18-12, but fixing only. | Metre | 140 |
| 18-23 | Same as item 18-4 or 18-13, but fixing only. | Metre | 140 |
| 18-24 | Same as item 18-5 or 18-14, but fixing only. | Metre | 142 |
| 18-25 | Same as item 18-6 or 18-15, but fixing only. | Metre | 163 |
| 18-26 | Same as item 18-7 or 18-16, but fixing only. | Metre | 168 |
| 18-27 | Same as item 18-8 or 18-17, but fixing only. | Metre | 168 |
| 18-28 | Same as item 18-9 or 18-18, but fixing only. | Metre | 208 |
| 18-29 | Same as item 18-19, but fixing only. | Metre | 248 |
| 18-30 | Add to item 18-1, 18-10 or 18-20 if removal only. | Metre | 104 |
| 18-31 | Add to item 18-2 or 18-11 or 18-21 if removal only. | Metre | 104 |
| 18-32 | Add to item 18-3 or 18-12 or 18-22 if removal only. | Metre | 78 |
| 18-33 | Add to item 18-4, 18-13 or 18-23 if removal only. | Metre | 78 |
| 18-34 | Add to item 18-5 or 18-14 or 18-24, if removal only. | Metre | 93 |
| 18-35 | Add to item 18-6 or 18-15 or 18-25 if removal only. | Metre | 106 |
| 18-36 | Add to item 18-7 or 18-16 or 18-26 if removal only. | Metre | 106 |
| 18-37 | Add to item 18-8 or 18-17 or 18-27 if removal only | Metre | 106 |
| 18-38 | Add to item 18-9 or 18-18 or 18-28 if removal only. | Metre | 129 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-39 | Add to item 18-9 or 18-29 if removal only. | Metre | 153 |
| 18-40 | **Tubes, Water Quality (GI)** with all fittings (i.e sockets, bends, tees, elbows, where required) and laid complete in trenches (excluding excavation) or fixed to walls, ceilings and floors etc, including caps and plugs as required, 200mm dia (4.8mm thickness), supply and fixing. | Metre | 7151 |
| 18-41 | Same as item 18-40 but 6.40 mm thickness, supply and fixing. | Metre | 8862 |
| 18-42 | Same as item 18-40 or 18-41, but fixing only. | Metre | 302 |
| 18-43 | Add to item 18-40, 18-41 or 18-42 if removal only. | Metre | 181 |
| 18-44 | Same as item 18-40 but 250 mm dia. (thickness 4.8mm) | Metre | 7855 |
| 18-45 | Same as item 18-44 but 6.40 mm thickness. | Metre | 11023 |
| 18-46 | Same as item 18-44, 18-45 but fixing only. | Metre | 551 |
| 18-47 | Add to item 18-44 , 18-45 or 18-46 if removal only | Metre | 207 |
| 18-48 | Same as item, 18-40 but 300 mm dia (6.4 mm thickness). | Metre | 13161 |
| 18-49 | Same as item 18-48 but 7.10 mm thickness. | Metre | 17267 |
| 18-50 | Same as item, 18-48, 18-49, but fixing only. | Metre | 400 |
| 18-51 | Add to item, 18-48, 18-49 or 18-50 if removal only. | Metre | 233 |
| 18-52 | **Tube MS Sch 40 without socket (weld less) BS specifications 20 mm dia supply and fixing** | Metre | 509 |
| 18-53 | Same as item 18-52, but 25 mm dia | Metre | 733 |
| 18-54 | Same as item 18-52 , but 32 mm dia | Metre | 964 |
| 18-55 | Same as item 18-52, but 40 mm dia | Metre | 1138 |
| 18-56 | Same as item 18-52, but 50 mm dia | Metre | 1498 |
| 18-57 | Same as item 18-52, but 65 mm dia | Metre | 2208 |
| 18-58 | Same as item 18-52, but 80 mm dia | Metre | 2928 |
| 18-59 | Same as item 18-52, but 100 mm dia | Metre | 4071 |
| 18-60 | Same as item 18-52, but 150 mm dia | Metre | 6957 |
| 18-61 | Same as item 18-52, but fixing only | Metre | 146 |
| 18-62 | Same as item 18-53, but fixing only | Metre | 190 |
| 18-63 | Same as item 18-54, but fixing only | Metre | 232 |
| 18-64 | Same as item 18-55, but fixing only | Metre | 268 |
| 18-65 | Same as item 18-56, but fixing only | Metre | 384 |
| 18-66 | Same as item 18-57, but fixing only | Metre | 456 |
| 18-67 | Same as item 18-58, but fixing only. | Metre | 672 |
| 18-68 | Same as item 18-59, but fixing only. | Metre | 672 |
| 18-69 | Same as item 18-60, but fixing only. | Metre | 957 |
| 18-70 | Add to item 18-52 or 18-61 if removal only | Metre | 66 |
| 18-71 | Add to item 18-53 or 18-62 if removal only | Metre | 71 |
| 18-72 | Add to item 18- 54 or18-63 if removal only | Metre | 83 |
| 18-73 | Add to item 18-55 or 18-64 if removal only | Metre | 89 |
| 18-74 | Add to item 18- 56 or18-65 if removal only. | Metre | 96 |
| 18-75 | Add to item 18- 57 or 18-66 if removal only. | Metre | 106 |
| 18-76 | Add to item 18-58 or 18-67 if removal only. | Metre | 112 |
| 18-77 | Add to item 18-59 or 18-68 if removal only. | Metre | 119 |
| 18-78 | Add to item 18-60 or 18-69 if removal only. | Metre | 129 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| | **MS - Pipes / Fittings** | | |
| 18-79 | **MS pipe,** Water Quality **(heavy),** 20 mm dia, with all fittings i.e. sockets, bends, tees, elbows etc where required, laid complete in trenches, as specified in para 18-1-4 (excluding cost of excavation), supply and fixing. | Metre | 490 |
| 18-80 | Same as item 18-79 but 25 mm dia | Metre | 600 |
| 18-81 | Same as item 18-79 but 40 mm dia | Metre | 891 |
| 18-82 | Same as item 18-79 but 50 mm dia | Metre | 888 |
| 18-83 | Same as item 18-79 but 65 mm dia | Metre | 1568 |
| 18-84 | Same as item 18-79 but 80 mm dia | Metre | 1806 |
| 18-85 | Same as item 18-79 but 100 mm dia | Metre | 2843 |
| 18-86 | Same as item 18-79 but 150 mm dia | Metre | 4632 |
| 18-87 | Same as item 18-79 but fixing only | Metre | 86 |
| 18-88 | Same as item 18-80 but fixing only | Metre | 104 |
| 18-89 | Same as item 18-81 but fixing only | Metre | 124 |
| 18-90 | Same as item 18-82 but fixing only | Metre | 141 |
| 18-91 | Same as item 18-83 but fixing only | Metre | 155 |
| 18-92 | Same as item 18-84 or 18-85 but fixing only. | Metre | 173 |
| 18-93 | Same as item 18-86 but fixing only. | Metre | 204 |
| 18-94 | Add to item 18-79 or 18-87 if removal only. | Metre | 65 |
| 18-95 | Add to item, 18-80 or 18-88 if removal only. | Metre | 78 |
| 18-96 | Add to item 18-81 or 18-89 if removal only. | Metre | 93 |
| 18-97 | Add to item 18-82 or 18-90 if removal only. | Metre | 106 |
| 18-98 | Add to item 18-83 or 18-91 or if removal only. | Metre | 116 |
| 18-99 | Add to item 18-84 or 18-85 18-92 if removal only. | Metre | 129 |
| 18-100 | Add to item 18-86 or 18-93 if removal only. | Metre | 153 |
| 18-101 | **Tubes, Steam Quality,** without socket (weld-less), BS Specifications, 15mm dia, supply and fixing. | Metre | 414 |
| 18-102 | Same as item 18-101 but 20 mm dia. | Metre | 543 |
| 18-103 | Same as item 18-101 but 25 mm dia. | Metre | 761 |
| 18-104 | Same as item 18-101 but 40 mm dia. | Metre | 1186 |
| 18-105 | Same as item 18-101 but 50 mm dia. | Metre | 1529 |
| 18-106 | Same as item 18-101 but 65 mm dia. | Metre | 2203 |
| 18-107 | Same as item 18-101 but 80 mm dia. | Metre | 2990 |
| 18-108 | Same as item 18-101 but fixing only. | Metre | 140 |
| 18-109 | Same as item 18-102 but fixing only. | Metre | 181 |
| 18-110 | Same as item 18-103 but fixing only. | Metre | 221 |
| 18-111 | Same as item 18-104 but fixing only. | Metre | 312 |
| 18-112 | Same as item 18-105 but fixing only. | Metre | 389 |
| 18-113 | Same as item 18-106 but fixing only. | Metre | 499 |
| 18-114 | Same as item 18-107 but fixing only. | Metre | 590 |
| 18-115 | Add to item 18-101or 18-108 if removal only. | Metre | 25 |
| 18-116 | Add to item 18-102 or 18-109 if removal only. | Metre | 30 |
| 18-117 | Add to item 18-103 or18-110 if removal only. | Metre | 35 |
| 18-118 | Add to item 18-104 or 18-111 if removal only. | Metre | 40 |
| 18-119 | Add to item 18-105 or 18-112 if removal only. | Metre | 54 |

| Sl No. | Description | Unit | Rate(Rs) j |
|---|---|---|---|
| 18-120 | Add to item 18-106 or 18-113 if removal only. | Metre | 74 |
| 18-121 | Add to item 18-107 or 18-114 if removal only. | Metre | 74 |
| 18-122 | Prepare surface clean of all dust, dirt etc, of **MS pipe** 15mm dia and applying two coats of bitumen solution and then wrap all around with bitumen paper duly dipped in bitumen solution with overlap of 100mm (excluding cost of pipe). | Metre | 59 |
| 18-123 | Same as item 18-122 but 20 mm dia pipe. | Metre | 74 |
| 18-124 | Same as item 18-122 but 25 mm dia pipe. | Metre | 90 |
| 18-125 | Same as item 18-122, but 32 mm dia pipe. | Metre | 94 |
| 18-126 | Same as item 18-122 but 40 mm dia pipe. | Metre | 127 |
| 18-127 | Same as item 18-122 but 50 mm dia pipe. | Metre | 154 |
| 18-128 | Same as item 18-122 but 65 mm dia pipe. | Metre | 201 |
| 18-129 | Same as item 18-122 but 80 mm dia pipe. | Metre | 223 |
| 18-130 | Same as item 18-122 but 100 mm dia pipe. | Metre | 282 |
| 18-131 | Same as item 18-122 but 150 mm dia pipe. | Metre | 375 |
| | **Socket- GI** | | |
| 18-132 | Socket GI, 15 mm dia, supply and fixing. | Each | 49 |
| 18-133 | Same as item 18-132 but 20 mm dia. | Each | 91 |
| 18-134 | Same as item 18-132 but 25 mm dia. | Each | 115 |
| 18-135 | Same as item 18-132, but 32 mm dia. | Each | 160 |
| 18-136 | Same as item 18-132 but 40 mm dia. | Each | 187 |
| 18-137 | Same as item 18-132 but 50 mm dia. | Each | 303 |
| 18-138 | Same as item 18-132 but 65 mm dia. | Each | 548 |
| 18-139 | Same as item 18-132 but 80 mm dia. | Each | 890 |
| 18-140 | Same as item 18-132 but 100 mm dia. | Each | 1310 |
| 18-141 | Same as item 18-132 but 150 mm dia. | Each | 4032 |
| | **Socket Reducing - GI** | | |
| 18-142 | Socket reducing GI, 20 mm x 15 mm dia, supply and fixing. | Each | 79 |
| 18-143 | Same as item 18-142 but 25 x 20 mm dia. | Each | 118 |
| 18-144 | Same as item 18-142, but 32 x 25 mm dia. | Each | 182 |
| 18-145 | Same as item 18-142 but 40 x 25 mm dia. | Each | 215 |
| 18-146 | Same as item 18-142 but 50 x 40 mm dia. | Each | 320 |
| 18-147 | Same as item 18-142 but 65 x 50 mm dia. | Each | 615 |
| 18-148 | Same as item 18-142 but 80 x 65 mm dia. | Each | 1031 |
| 18-149 | Same as item 18-142 but 100 x 80 mm dia. | Each | 1673 |
| 18-150 | Same as item 18-142 but 150 x 100 mm dia | Each | 4760 |
| | **Bend GI 45°/ 90°** | | |
| 18-151 | Bend GI 45°/ 90°, 15 mm dia, supply and fixing. | Each | 109 |
| 18-152 | Same as item 18-151 but 20 mm dia. | Each | 145 |
| .18-153 | Same as item, 18-151 but 25 mm dia. | Each | 244 |
| 18-154 | Same as item 18-151, but 32 mm dia. | Each | 401 |
| 18-155 | Same as item 18-151 but 40 mm dia. | Each | 530 |
| 18-156 | Same as item 18-151 but 50 mm dia. | Each | 899 |
| 18-157 | Same as item 18-151 but 65 mm dia. | Each | 1661 |
| 18-158 | Same as item 18-151 but 80 mm dia. | Each | 2370 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-159 | Same as item 18-151 but 100 mm dia. | Each | 4519 |
| 18-160 | Same as item 18-151 but 150 mm dia. | Each | 15737 |
| | **Elbow-GI** | | |
| 18-161 | Elbow GI, 15 mm dia, supply and fixing. | Each | 55 |
| 18-162 | Same as item 18-161 but 20 mm dia. | Each | 82 |
| 18-163 | Same as item 18-161 but 25 mm dia. | Each | 177 |
| 18-164 | Same as item 18-161, but 32 mm dia. | Each | 195 |
| 18-165 | Same as item 18-161 but 40 mm dia. | Each | 249 |
| 18-166 | Same as item 18-161 but 50 mm dia. | Each | 432 |
| 18-167 | Same as item 18-161 but 65 mm dia. | Each | 734 |
| 18-168 | Same as item 18-161 but 80 mm dia. | Each | 1352 |
| 18-169 | Same as item 18-161 but 100 mm dia. | Each | 2264 |
| 18-170 | Same as item 18-161 but 150 mm dia. | Each | 6819 |
| 18-171 | Same as item 18-132, 18-151, or 18-161 but fixing only. | Each | 11 |
| 18-172 | Same as item 18-133, 18-142, 18-152 or 18-162 but fixing only. | Each | 13 |
| 18-173 | Same as item, 18-134, 18-143, 18-153 or 18-163 but fixing only. | Each | 14 |
| 18-174 | Same as item 18-135, 18-144, 18-154 or 18-164 but fixing only. | Each | 9 |
| 18-175 | Same as item 18-136, 18-145, 18-155, or18-165 but fixing only. | Each | 18 |
| 18-176 | Same as item 18-137, 18-146, 18-156 or 18-166 but fixing only. | Each | 23 |
| 18-177 | Same as item, 18-138, 18-147, 18-157, or 18-167 but fixing only. | Each | 24 |
| 18-178 | Same as item 18-139, 18-148, 18-158 or 18-168 but fixing only. | Each | 35 |
| 18-179 | Same as item 18-140, 18-149, 18-159 or 18-169 but fixing only. | Each | 35 |
| 18-180 | Same as item 18-141, 18-150, 18-160 or 18-170 but fixing only. | Each | 42 |
| 18-181 | Add to item 18-132, 18-151,18-161or 18-171 if removal only. | Each | 4 |
| 18-182 | Add to item 18-133,18-142, 18-152, 18-162, or 18-172 if removal only | Each | 5 |
| 18-183 | Add to item 18-134, 18-143,18-153, 18-163 or 18-173 if removal only. | Each | 8 |
| 18-184 | Add to item 18-,135, 18-144, 18-154, 18-164 or 18-174 if removal only. | Each | 6 |
| 18-185 | Add to item 18-136, 18-145, 18-155, 18-165 or 18-175 if removal only | Each | 8 |
| 18-186 | Add to item 18-137, 18-146, 18-156, 18-166, 18-176 if removal only. | Each | 11 |
| 18-187 | Add to item 18-138, 18-147, 18-157, 18-167 or 18-177 if removal only. | Each | 11 |
| 18-188 | Add to item 18-139, 18-148, 18-158, 18-168 or 18-178 if removal only. | Each | 16 |
| 18-189 | Add to item 18-140, 18-149, 18-159, 18-169 or 18-179 if removal only. | Each | 18 |
| 18-190 | Add to item 18-141, 18-150, 18-160, 18-170 or 18-180 if removal only. | Each | 18 |
| | **Tee Equal - GI** | | |
| 18-191 | Tee equal GI 15 mm dia, supply and fixing | Each | 71 |
| 18-192 | Same as ;tem 18-191 but 20 mm dia. | Each | 116 |
| 18-193 | Same as item 18-191 but 25 mm dia. | Each | 187 |
| 18-194 | Same as item 18-191 but 32 mm dia. | Each | 257 |
| 18-195 | Same as item 18-191 but 40 mm dia. | Each | 322 |
| 18-196 | Same as item 18-191 but 50 mm dia. | Each | 475 |
| 18-197 | Same as item 18-191 but 65 mm dia. | Each | 1133 |
| 18-198 | Same as item 18-191 but 80 mm dia. | Each | 1634 |
| 18-199 | Same as item 18-191 but 100 mm dia. | Each | 2642 |
| 18-200 | Same as item 18-191 but 150 mm dia. | Each | 11044 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| | **Tee Reducing - GI** | | |
| 18-201 | Tee reducing GI, 20x15 mm dia, supply and fixing. | Each | 129 |
| 18-202 | Same as item 18-201 but 25 x 20 mm dia | Each | 212 |
| 18-203 | Same as item 18-201 but 32 x 15 mm dia | Each | 310 |
| 18-204 | Same as item 18-201 but 32 x 25 mm dia | Each | 316 |
| 18-205 | Same as item 18-201 but 40 x 25 mm dia | Each | 411 |
| 18-206 | Same as item 18-201 but 50 x 40 mm dia | Each | 583 |
| 18-207 | Same as item 18-201 but 65 x 50 mm dia | Each | 1289 |
| 18-208 | Same as item 18-201 but 80 x 65 mm dia. | Each | 2018 |
| 18-209 | Same as item 18-201 but 100 x 80 mm dia | Each | 3074 |
| 18-210 | Same as item 18-201 but 150 x100 mm dia | Each | 12485 |
| | **Union Socket- GI** | | |
| 18-211 | Union socket GI, screwed BSS, 15 mm dia, supply and fixing. | Each | 162 |
| 18-212 | Same as item, 18-211 but 20 mm dia. | Each | 213 |
| 18-213 | Same as item, 18-211 but 25 mm dia. | Each | 284 |
| 18-214 | Same as item 18-211, but 32 mm dia. | Each | 395 |
| 18-215 | Same as item, 18-211 but 40 mm dia. | Each | 535 |
| 18-216 | Same as item 18-211 but 50 mm dia. | Each | 764 |
| 18-217 | Same as item 18-211 but 65 mm dia. | Each | 1559 |
| 18-218 | Same as item 18-211 but 80 mm dia. | Each | 2072 |
| 18-219 | Same as item 18-211 but 100 mm dia. | Each | 3856 |
| 18-220 | Same as item 18-191, 18-201, 18-211 but fixing only. | Each | 14 |
| 18-221 | Same as item 18-192, 18-202, 18-212 but fixing only. | Each | 17 |
| 18-222 | Same as item 18-193, 18-203, 18-213 but fixing only. | Each | 20 |
| 18-223 | Same as item 18-194, 18-204, 18-214 but fixing only | Each | 22 |
| 18-224 | Same as item 18-195, 18-205, 18-215 but fixing only | Each | 24 |
| 18-225 | Same as item 18-196, 18-206, 18-216 but fixing only. | Each | 30 |
| 18-226 | Same as item 18-197, 18-207, 18-217 but fixing only. | Each | 31 |
| 18-227 | Same as item 18-198, 18-208, 18-218 but fixing only. | Each | 40 |
| 18-228 | Same as item 18-199, 18-209, 18-219 but fixing only. | Each | 46 |
| 18-229 | Same as item 18-200, 18-210 but fixing only. | Each | 54 |
| 18-230 | Add to item 18-191, 18-201, 18-211 or 18-220 if removal only. | Each | 6 |
| 18-231 | Add to item 18-192, 18-202, 18-212, 18-221 if removal only. | Each | 8 |
| 18-232 | Add to item 18-193, 18-203, 18-213, or 18-222 if removal only. | Each | 10 |
| 18-233 | Add to item 18-194, 18-204, 18-214 or 18-223 if removal only. | Each | 11 |
| 18-234 | Add to item 18-195, 18-205, 18-215, Or 18-224 if removal only. | Each | 12 |
| 18-235 | Add to item 18-196, 18-206, 18-216, or 18-225 if removal only. | Each | 16 |
| 18-236 | Add to item 18-197, 18-207, 18-217 or 18-226 if removal only. | Each | 16 |
| 18-237 | Add to item 18-198, 18-208, 18-218, or 18-227 if removal only. | Each | 19 |
| 18-238 | Add to item 18-199, 18-209, 18-219 or 18-228 if removal only. | Each | 23 |
| 18-239 | Add to item 18-200, 18-210, or 18-229 if removal only. | Each | 27 |
| | **Nipple-GI** | | |
| 18-240 | Nipple, 15 mm dia, supply and fixing | Each | 58 |
| 18-241 | Same as item 18-240, but 20 mm dia | Each | 91 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-242 | Same as item 18-240, but 25 mm dia | Each | 110 |
| 18-243 | Same as item 18-240, but 32 mm dia | Each | 141 |
| 18-244 | Same as item 18-240, but 40 mrr. dia | Each | 197 |
| 18-245 | Same as item 18-240, but 50 mm dia | Each | 304 |
| 18-246 | Sarne as item 18-240, but 65 mm dia | Each | 456 |
| 18-247 | Same as item 18-240, but 80 mm dia | Each | 838 |
| 18-248 | Same as item 18-240, but 100 mm dia | Each | 1240 |
| 18-249 | Same as item 18-240 but 150 mm dia | Each | 4186 |
| 18-250 | Same as item 18-240, but fixing only. | Each | 12 |
| 18-251 | Same as item 18-241 but fixing only. | Each | 12 |
| 18-252 | Same as item 18-242 but fixing only. | Each | 14 |
| 18-253 | Same as item 18-243, but fixing only. | Each | 17 |
| 18-254 | Same as item 18-244, but fixing only. | Each | 18 |
| 18-255 | Same as item 18-245, but fixing only. | Each | 23 |
| 18-256 | Same as item 18-246, but fixing only. | Each | **24** |
| 18-257 | Same as item 18-247, but fixing only. | Each | 32 |
| 18-258 | Same as item 18-248, but fixing only. | Each | 36 |
| 18-259 | Same as item 18-249, but fixing only. | Each | **42** |
| 18-260 | Add to item 18-240 or 18-250 if removal only. | Each | 6 |
| 18-261 | Add to item 18-241 or 18-251 if removal only. | Each | 7 |
| 18-262 | Add to item 18-242 or 18-252 if removal only. | Each | 8 |
| 18-263 | Add to item 18-243 or 18-253 if removal only. | Each | 9 |
| 18-264 | Add to item 18-244 or 18-254 if removal only. | Each | 14 |
| 18-265 | Add to item 18-245 or 18-255 if removal only. | Each | 14 |
| 18-266 | Add to item 18-246 or 18-256 if removal only. | Each | 14 |
| 18-267 | Add to item 18-247 or 18-257 if removal only. | Each | 17 |
| 18-268 | Add to item 18-248 or 18-258 if removal only. | Each | 18 |
| 18-269 | Add to item 18-249 or 18-259 if removal only. | Each | **24** |
| | **Check Nut - GI** | | |
| 18-270 | Check nut GI, 15 mm dia, supply and fixing. | Each | 29 |
| 18-271 | Same as item 18-270 but 20 mm dia. | Each | 38 |
| 18-272 | Same as item 18-270 but 25 mm dia. | Each | 44 |
| 18-273 | Same as item 18-270 but 32 mm dia. | Each | 40 |
| 18-274 | Same as item 18-270 but 40 mm dia. | Each | 62 |
| 18-275 | Same as item 18-270 but 50 mm dia. | Each | 84 |
| 18-276 | Same as item 18-270 but 65 mm dia. | Each | 144 |
| 18-277 | Same as item 18-270 but 80 mm dia. | Each | 196 |
| 18-278 | Same as item 18-270 but 100 mm dia. | Each | 361 |
| 18-279 | Same as item 18-270 but 150 mm dia. | Each | 740 |
| | **Plugs - GI / MS** | | |
| 18-280 | **GI/MS plug** screwed BSS, 15 mm dia, supply and fixing. | Each | 17 |
| 18-281 | Same as item 18-280 but 20 mm dia. | Each | 26 |
| 18-282 | Same as item 18-280 but 25 mm dia. | Each | 28 |
| 18-283 | Same as item 18-280 but 32 mm dia. | Each | 79 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-284 | Same as item 18-280 but 40 mm dia. | Each | 56 |
| 18-285 | Same as item 18-280 but 50 mm dia. | Each | 75 |
| 18-286 | Same as item 18-280 but 65 mm dia. | Each | 157 |
| 18-287 | Same as item 18-280 but 80 mm dia. | Each | 184 |
| 18-288 | Same as item 18-280 but 100 mm dia. | Each | 331 |
| 18-289 | Same as item 18-270 or 18-280 but fixing only. | Each | 6 |
| 18-290 | Same as item 18-271 or 18-281 but fixing only. | Each | 8 |
| 18-291 | Same as item 18-272 or 18-282 but fixing only. | Each | 8 |
| 18-292 | Same as item 18-273 or 18-283, but fixing only. | Each | 4 |
| 18-293 | Same as item 18-274 or 18-284 but fixing only. | Each | 11 |
| 18-294 | Same as item 18-275 or 18-285 but fixing only | Each | 12 |
| 18-295 | Same as item 18-276 or 18-286 but fixing only. | Each | 12 |
| 18-296 | Same as item 18-277 or 18-287 but fixing only. | Each | 16 |
| 18-297 | Same as item 18-278 or 18-288 but fixing only. | Each | 19 |
| 18-298 | Same as item 18-279 but fixing only. | Each | 16 |
| 18-299 | Add to item 18-270, 18-280 or 18-289 if removal only. | Each | 2 |
| 18-300 | Add to item 18-271, 18-281 or 18-290 if removal only. | Each | 4 |
| 18-301 | Add to item 18-272, 18-282 or 18-291 if removal only. | Each | 3 |
| 18-302 | Add to item 18-273, 18-283 or 18-292 if removal only. | Each | 3 |
| 18-303 | Add to item 18-274 18-284 or 18-293 if removal only. | Each | 4 |
| 18-304 | Add to item 18-275, 18-285 or 18-294 if removal only. | Each | 5 |
| 18-305 | Add to item 18-276, 18-286 or 18-295 if removal only. | Each | 5 |
| 18-306 | Add to item 18-277, 18-287 or 18-296 if removal only. | Each | 6 |
| 18-307 | Add to item 18-278, 18-288 or 18-297 if removal only. | Each | 8 |
| 18-308 | Add to item 18-279 or 18-298 if removal only. | Each | 9 |
| 18-309 | **Canvas pipe** of 40 mm dia, supply and fixing. | Metre | 323 |
| 18-310 | Same as item 18-309, but 50 mm dia. | Metre | 361 |
| 18-311 | Same as item 18-309, but 65 mm dia. | Metre | 421 |
| 18-312 | Same as item 18-309, but 75 / 80mm dia. | Metre | 461 |
| 18-313 | Same as item 18-309 to 18-312 but fixing only. | Metre | 86 |
| 18-314 | Add to item 18-309 to 18-312 or 18-313, if removal only. | Metre | 65 |
| | **Bib Cocks - (Brass, Bright)** | | |
| 18-315 | Bib cock, Brass, CP, fancy type, screwed down, BSS, 15 mm dia, Supply and fixing. | Each | 740 |
| 18-316 | Same as item 18-315, but with long head. | Each | 902 |
| 18-317 | Same as item 18-315, but toilet bib cock (Double). | Each | 1334 |
| 18-318 | Same as item 18-315, but Ordinary type. | Each | 758 |
| 18-319 | Same as item 18-315, to 18-318, but fixing only. | Each | 38 |
| 18-320 | Add to item 18-315 to 18-319, if removal only. | Each | 26 |
| 18-321 | CP Nipple 15x150 mm for CP bib cock and shower, supply and fixing. | Each | 278 |
| 18-322 | Same as item 18-321, but 15 x 125 mm. | Each | 211 |
| 18-323 | Same as item 18-321, but 15 x 80 mm. | Each | 176 |
| 18-324 | Same as item 18-321, but 15 x 50 mm. | Each | 109 |
| 18-325 | Same as item 18-321 to 18-324, but fixing only. | Each | 38 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-326 | Add to item 18-321 to 18-324, or 18-325, if removal only. | Each | 26 |
| | **Bath and Lavatory Cocks - (CP)** | | |
| 18-327 | **CP Pillar cock,** high neck fancy head, screw down, hiç pressure, lettered Hot or Cold, with long screw, shank and fly nuts, fixed on iron pipe 15mm dia, supply and fixing. | Each | 1510 |
| 18-328 | **CP Mixer,** 15mm dia, fancy head, any pattern and shape, screw down, high pressure, lettered Hot and cold with long screw channels and fly nuts complete, supply and fixing. | Each | 2425 |
| 18-329 | Same as 18-327 to 18-328, but fixing only. | Each | 157 |
| 18-330 | Add to item 18-327, 18-328 or 18-329, if removal only. | Each | 114 |
| | **Stop Cock** | | |
| 18-331 | Stop cock brass, CP, screw down, high pressure, fan type, 15mm dia, supply and fixing. | Each | 743 |
| 18-332 | Same as item 18- 331 but concealed type. | Each | 966 |
| 18-333 | Same as item 18-331, but tee stop cock. | Each | 743 |
| 18-334 | Same as item 18-331 to 18-333, but fixing only. | Each | 41 |
| 18-335 | Add to item 18-331 to 18-333 or 18-334, if removal only. | Each | 26 |
| | **Water Meters Digital** | | |
| 18-336 | Electromagnetic smart water meter, 20 mm dia for cold water ±_0.1°C, water nominal pressure 16 bar, length 190 mm, threaded ends G-1¼", R800, LCD, m3 reading, 433 MhZ wM-Bus & Sensus RF radio protocol, battery life, max 15 years, supply & fixing. | Each | 21648 |
| 18-337 | Same as item 18-336, but 25 mm dia length 198 mm | Each | 26456 |
| 18-338 | Same as item 18-336, but 40 mm dia length 300 mm | Each | 38472 |
| 18-339 | Same as item 18-336, but 50 mm dia length 270 mm | Each | 67290 |
| 18-340 | Same as item 18-336 but 65 mm dia, Flow sensor MAG 5100 W, Length 200 mm for water upto 70°C, Flanged type, Coating grey, LCD indicator. | Each | 360297 |
| 18-341 | Same as item 18-336, but 80 mm dia length 200 mm | Each | 384297 |
| 18-342 | Same as item 18-336, but 100 mm dia length 200 mm | Each | 408354 |
| 18-343 | Same as item 18-336 to 18-342 but fixing only. | Each | 173 |
| 18-344 | Add to item 18-336 to 18-342 or 18-343 if removal only. | Each | 121 |
| | **Valves** | | |
| 18-345 | Valves, **"Peet" pattern,** strong gunmetal, high pressure, "Full-way" with iron wheel head, screwed both ends for iron pipe, 15 mm dia, supply and fixing. | Each | 551 |
| 18-346 | Same as item 18-345, but 20 mm dia. | Each | 816 |
| 18-347 | Same as item 18-345, but 25 mm dia. | Each | 1231 |
| 18-348 | Same as item 18-345, but 40 mm dia. | Each | 2111 |
| 18-349 | Same as item 18-345, but 50 mm dia. | Each | 3805 |
| 18-350 | Same as item 18-345, but 65 mm dia. | Each | 4647 |
| 18-351 | **Globe valves,** gunmetal, screwed both ends, complete with steel handle Class-150, 15 mm dia, supply and fixing. | Each | 1205 |
| 18-352 | Same as item 18-351, but 20 mm dia. | Each | 1488 |
| 18-353 | Same as item 18-351, but 25 mm dia. | Each | 2215 |
| 18-354 | Same as item 18-351, but 40 mm dia. | Each | 3311 |
| 18-355 | Same as item 18-351, but 50 mm dia. | Each | 5185 |
| 18-356 | Same as item 18-351, but 65 mm dia. | Each | 7887 |
| 18-357 | **Globe valves,** gunmetal, flanged and drilled to BS Table 18-1-10, complete with steel handle Class-150, 80mm dia, supply and fixing. | Each | 11397 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-358 | Same as item 18-357, but 100mm dia, with Cl body. | Each | 16021 |
| 18-359 | Same as item 18-357, but 150mm dia, with Cl body. | Each | 25856 |
| | **Sluice Valves** | | |
| 18-360 | Sluice Valve, according to **BSS-3464** class 150,(Table 18-1-6) flanged and drilled to BS, Table 18-1-10, complete with rubber packing, 80 mm dia, supply and fixing. | Each | 11397 |
| 18-361 | Same as item 18-360, but 100 mm dia | Each | 14221 |
| 18-362 | Same as item 18-360, but 150 mm dia | Each | 23012 |
| 18-363 | Same as item 18-360, but 200 mm dia. | Each | 36305 |
| 18-364 | Same as item 18-360, but 250 mm dia. | Each | 66885 |
| 18-365 | Same as item 18-360, but 300 mm dia. | Each | 101092 |
| 18-366 | Sluice Valve, according to **BSS-5150/5163,** PN-16, (Table 18-1-8) flanged and drilled to BS Table 18-1-10, complete with rubber packing, 80 mm dia, supply and fixing. | Each | 11637 |
| 18-367 | Same as item 18-366, but 100 mm dia. | Each | 19261 |
| 18-368 | Same as item 18-366, but 150 mm dia. | Each | 24056 |
| 18-369 | Same as item 18-366, but 200 mm dia. | Each | 38465 |
| 18-370 | Same as item 18-366, but 250 mm dia. | Each | 70485 |
| 18-371 | Same as item 18-366, but 300 mm dia. | Each | 108232 |
| | **Non Return Valves** | | |
| 18-372 | Non return valve or reflux valve, screwed, 15 mm dia, supply and fixing. | Each | 1060 |
| 18-373 | Same as item 18-372 but 20 mm dia. | Each | 1304 |
| 18-374 | Same as item 18-372, but 25 mm dia. | Each | 1855 |
| 18-375 | Same as item 18-372, but 40 mm dia. | Each | 2711 |
| 18-376 | Same as item 18-372, but 50 mm dia. | Each | 5845 |
| 18-377 | Same as item 18-372, but 65 mm dia. | Each | 7287 |
| 18-378 | Same as item 18-372, flanged and drilled to BS Table 18-1-10, 80 mm dia. | Each | 11877 |
| 18-379 | Same as item 18-378, but 100 mm dia. | Each | 15901 |
| 18-380 | Same as item 18-378, but 150 mm dia. | Each | 21656 |
| 18-381 | Same as item 18-378, but 200 mm dia. | Each | 34489 |
| 18-382 | Same as item 18-345, 18-351, 18-372, but fixing only. | Each | 37 |
| 18-383 | Same as item 18-346, 18-352, or18-373, but fixing only. | Each | 48 |
| 18-384 | Same as item 18-347, 18-353, or 18-374, but fixing only. | Each | 55 |
| 18-385 | Same as item 18-348, 18-354, or18-375, but fixing only. | Each | 71 |
| 18-386 | Same as item 18-349, 18-355, or 18-376, but fixing only. | Each | 85 |
| 18-387 | Same as item 18-350, 18-356 or 18-377 but fixing only. | Each | 87 |
| 18-388 | Same as item 18-357, 18-360, 18-366, or 18-378 but fixing only. | Each | 357 |
| 18-389 | Same as item 18-358, 18-361, 18-367or 18-379 but fixing only. | Each | 421 |
| 18-390 | Same as item 18-359, 18-362, 18-368 or 18-380, but fixing only. | Each | 656 |
| 18-391 | Same as item 18-363, 18-369, or 18-381, but fixing only. | Each | 785 |
| 18-392 | Same as item 18-364 or 18-370, but fixing only. | Each | 885 |
| 18-393 | Same as item 18-365 or, 18-371, but fixing only. | Each | 1432 |
| 18-394 | Add to item 18-345, 18-351, 18-372 or 18-382, if removal only. | Each | 26 |
| 18-395 | Add to item 18-346, 18-352, 18-373, or 18-383 if removal only. | Each | 31 |
| 18-396 | Add to item 18-347, 18-353, 18-374, or 18-384 if removal only. | Each | 36 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-397 | Add to item 18-348, 18-354, 18-375, or 18-385, if removal only. | Each | 47 |
| 18-398 | Add to item 18-349, 18-355, 18-376, or 18-386 if removal only. | Each | 57 |
| 18-399 | Add to item 18-350, 18-356, 18-377, or 18-387 if removal only. | Each | 57 |
| 18-400 | Add to item 18-357, 18-360, 18-366, 18-378 or 18-388, if removal only. | Each | 129 |
| 18-401 | Add to item 18-358, 18-361, 18-367, 18-379 or 18-389, if removal only. | Each | 195 |
| 18-402 | Add to item 18-359, 18-362, 18-368, 18-380 or 18-390, if removal only. | Each | 307 |
| 18-403 | Add to item 18-363, 18-369, 18-381 or 18-391, if removal only. | Each | 369 |
| | Add to item 18-364 or 18-370 or 18-392, if removal only. | Each | 395 |
| | Add to item 18-365, 18-371 or 18-393, if removal only | Each | 661 |
| | **Ball / Float Valves** | | |
| | Ball valves, brass (Corydon) or other approved pattern, with plastic ball screwed for iron (brass ferrule), 15mm dia supply and fixing. | Each | 727 |
| | Same as item 18-406, but 20mm dia. | Each | 1234 |
| | Same as item 18-406, but 25mm dia. | Each | 1673 |
| | Same as item 18-406, with copper ball, but 40mm dia. | Each | 3857 |
| | Same as item 18-406, but 50 mm dia. | Each | 5485 |
| | **Foot Valve** | | |
| | Foot valve complete with strainer screwed 25mm dia, supply and fixing. | Each | 783 |
| | Same as item 18-411, but 40 mm dia. | Each | 2052 |
| | Same as item 18-411, but 50 mm dia. | Each | 2727 |
| | Same as item 18-411, but 65 mm dia. | Each | 4143 |
| | Same as item 18-411, but flanged and drilled to BS Table 18-1-10, 80 mm dia. | Each | 5179 |
| | Same as item 18-415, but 100 mm dia | Each | 7474 |
| | Same as item 18-415, but 150 mm dia | Each | 11333 |
| | Same as item 18-415, but 200 mm dia | Each | 18038 |
| | Same as item 18-406 to 18-408 or 18-411, but fixing only. | Each | 57 |
| | Same as item 18-409 or 18-412, but fixing only. | Each | 72 |
| | Same as item 18-410 or 18-413, but fixing only. | Each | 87 |
| | Same as item 18-414, but fixing only. | Each | 183 |
| | Same as item 18-415, but fixing only. | Each | 295 |
| | Same as item 18-416, but fixing only. | Each | 341 |
| | Same as item 18-417, but fixing only. | Each | 533 |
| | Same as item 18-418, but fixing only. | Each | 437 |
| | Add to item 18-406 to 18-408, 18-411 or 18-419, if removal only. | Each | 36 |
| | Add to item 18-409, 18-412 or 18-420, if removal only. | Each | 47 |
| | Add to item 18-410, 18-413 or 18-421, if removal only. | Each | 57 |
| | Add to item 18-414 or 18-422, if removal only. | Each | 129 |
| | Add to item 18-415 or 18-423, if removal only. | Each | 174 |
| | Add to item 18-416 or 18-424, if removal only. | Each | 195 |
| | Add to item 18-417 or 18-425, if removal only. | Each | 307 |
| 18-434 | Add to item 18-418 or 18-426, if removal only. | Each | 369 |
| | **Air Valves** | | |
| 18-435 | Air valve automatic, 50 mm size, single acting, supply and fixing. | Each | 6085 |
| 18-436 | Same as item 18-435, but double acting. | Each | 17965 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-437 | Same as item 18-435 or 18-436, but fixing only. | Each | 85 |
| 18-438 | Add to item 18-435, 18-436 or 18-437, if removal only. | Each | 57 |
| | **Fire Hydrant** | | |
| 18-439 | Fire Hydrant flanged and drilled to BS Table 18-1-10, complete with rubber packing, 65 mm dia, supply and fixing. | Each | 19670 |
| 18-440 | Same as 18-439, but 80 mm dia. | Each | 22670 |
| 18-441 | Same as item 18-439 or 18-440, but fixing only. | Each | 470 |
| 18-442 | Add to item 18-439, 18-440 or 18-441, if removal only. | Each | 259 |
| | **Flange - MS/ GI Screwed** | | |
| 18-443 | Flanges MS/GI, drilled to B.S Table 18-1-10, for screwed pipe, 25 mm dia, supply and fixing. | Each | 443 |
| 18-444 | Same as item 18-443, but 40mm dia. | Each | 515 |
| 18-445 | Same as item 18-443, but 50mm dia. | Each | 522 |
| 18-446 | Same as item 18-443, but 65mm dia. | Each | 709 |
| 18-447 | Same as item 18-443, but 80mm dia. | Each | 797 |
| 18-448 | Same as item 18-443, but 100mm dia. | Each | 1470 |
| 18-449 | Same as item 18-443, but 150mm dia. | Each | 2113 |
| 18-450 | Same as item 18-443, but 200mm dia. | Each | 4110 |
| 18-451 | Same as item 18-443, but 250mm dia. | Each | 5887 |
| 18-452 | Same as item 18-443, but 300mm dia. | Each | 7307 |
| 18-453 | Same as item 18-443, but fixing only. | Each | 83 |
| 18-454 | Same as item 18-444, but fixing only. | Each | 95 |
| 18-455 | Same as item 18-445, but fixing only. | Each | 102 |
| 18-456 | Same as item 18-446, but fixing only. | Each | 166 |
| 18-457 | Same as item 18-447, but fixing only. | Each | 197 |
| 18-458 | Same as item 18-448, but fixing only. | Each | 211 |
| 18-459 | Same as item 18-449, but fixing only. | Each | 313 |
| 18-460 | Same as item 18-450, but fixing only. | Each | 429 |
| 18-461 | Same as item 18-451, but fixing only. | Each | 487 |
| 18-462 | Same as item 18-452, but fixing only. | Each | 689 |
| 18-463 | Add to item 18-443 or 18-453, if removal only. | Each | 18 |
| 18-464 | Add to item 18-444 or 18-454, if removal only. | Each | 23 |
| 18-465 | Add to item 18-445 or 18-455, if removal only. | Each | 28 |
| 18-466 | Add to item 18-446 or 18-456, if removal only. | Each | 52 |
| 18-467 | Add to item 18-447 or 18-457, if removal only. | Each | 65 |
| 18-468 | Add to item 18-448 or 18-458, if removal only. | Each | 98 |
| 18-469 | Add to item 18-449 or 18-459 if removal only. | Each | 122 |
| 18-470 | Add to item 18-450 or 18-460, if removal only. | Each | 184 |
| 18-471 | Add to item 18-451 or 18-461, if removal only. | Each | 197 |
| 18-472 | Add to item 18-452 or 18-462, if removal only. | Each | 276 |
| | **Flange - MS/ GI Welded** | | |
| 18-473 | Flanges MS/GI, drilled to B.S, Table 18-1-10, for Welded pipe, 25mm dia, supply and fixing. | Each | 388 |
| 18-474 | Same as item 18-473, but 40mm dia. | Each | 585 |
| 18-475 | Same as item 18-473, but 50mm dia. | Each | 683 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-476 | Same as item 18-473, but 65mm dia. | Each | 791 |
| 18-477 | Same as item 18-473, but 80mm dia. | Each | 902 |
| 18-478 | Same as item 18-473, but 100mm dia. | Each | 1397 |
| 18-479 | Same as item 18-473, but 150mm dia. | Each | 2142 |
| 18-480 | Same as item 18-473, but 200mm dia. | Each | 3089 |
| 18-481 | Same as item 18-473, but 250mm dia. | Each | 4335 |
| 18-482 | Same as item 18-473, but 300mm dia.. | Each | 5702 |
| 18-483 | Same as item 18-473, but fixing only. | Each | 150 |
| 18-484 | Same as item 18-474, but fixing only. | Each | 225 |
| 18-485 | Same as item 18-475, but fixing only. | Each | 299 |
| 18-486 | Same as item 18-476, but fixing only. | Each | 370 |
| 18-487 | Same as item 18-477, but fixing only. | Each | 445 |
| 18-488 | Same as item 18-478, but fixing only. | Each | 592 |
| 18-489 | Same as item 18-479, but fixing only. | Each | 881 |
| 18-490 | Same as item 18-480, but fixing only. | Each | 1168 |
| 18-491 | Same as item 18-481, but fixing only. | Each | 1455 |
| 18-492 | Same as item 18-482, but fixing only. | Each | 1743 |
| 18-493 | Add to item 18-473 or 18-483, if removal only. | Each | 6 |
| 18-494 | Add to item 18-474 or 18-484, if removal only. | Each | 10 |
| 18-495 | Add to item 18-475 or 18-485, if removal only. | Each | 14 |
| 18-496 | Add to item 18-476 or 18-486, if removal only. | Each | 13 |
| 18-497 | Add to item 18-477 or 18-487, if removal only. | Each | 17 |
| 18-498 | Add to item 18-478 or 18-488, if removal only. | Each | 20 |
| 18-499 | Add to item 18-479 or 18-489 if removal only. | Each | 23 |
| 18-500 | Add to item 18-480 or 18-490, if removal only. | Each | 23 |
| 18-501 | Add to item 18-481 or 18-491, if removal only. | Each | 23 |
| 18-502 | Add to item 18-482 or 18-492, if removal only. | Each | 23 |
| | **Brass Spindles** | | |
| 18-503 | Brass Spindle with nuts, for 80 mm dia, **Gate valves,** supply and fixing. | Each | 2246 |
| 18-504 | Same as item 18--503, but 100 mm dia. | Each | 3086 |
| 18-505 | Same as item 18-503, but 150 mm dia. | Each | 4646 |
| 18-506 | Same as item 18-503, but 200 mm dia. | Each | 5573 |
| 18-507 | Same as item 18-503, but 250 mm dia. | Each | 6533 |
| 18-508 | Same as item 18-503, but 300 mm dia. | Each | 11573 |
| 18-509 | Same to item 18-503 to 18-505, but fixing only. | Each | 86 |
| 18-510 | Same as item 18-506 to 18-508, but fixing only. | Each | 173 |
| 18-511 | Add to item 18-503 to 18-505 or 18-509 if removal only. | Each | 65 |
| 18-512 | Add to item 18-506 to 18-508 or 18-510 if removal only. | Each | 129 |
| | **Water Tanks - Polyethylene (PE)** | | |
| 18-513 | Water tank Polyethylene (PE) vertical, 50 gallons capacity, supply and fixing. | Each | 3465 |
| 18-514 | Same as item 18-513 but, 150 gallons capacity. | Each | 5865 |
| 18-515 | Same as item 18-513 but, 200 gallons capacity. | Each | 6825 |
| 18-516 | Same as item 18-513 but, 250 gallons capacity. | Each | 7665 |
| 18-517 | Same as item 18-513 but, 300 gallons capacity. | Each | 9518 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-518 | Same as item 18-513 but, 400 gallons capacity. | Each | 11678 |
| 18-519 | Same as item 18-513 but, 500 gallons capacity. | Each | 14078 |
| 18-520 | Same as item 18-513 but, 1000 gallons capacity. | Each | 55720 |
| 18-521 | Water tank Polyethylene (PE) **horizontal,** 150 gallons capacity, supply and fixing. | Each | 5865 |
| 18-522 | Same as item 18-521 but, 200 gallons capacity. | Each | 6825 |
| 18-523 | Same as item 18-521 but, 250 gallons capacity. | Each | 7665. |
| 18-524 | Same as item 18-521 but, 300 gallons capacity. | Each | 9518 |
| 18-525 | Same as 18-513 to 18-516 or 18-521 to 18-523, but fixing only. | Each | 465 |
| 18-526 | Same as 18-517 to 18-519 or 18-524, but fixing only. | Each | 878 |
| 18-527 | Same as 18-520, but fixing only. | Each | 2115 |
| 18-528 | Add to item 18-513 to 18-516, 18-521 to 18-523 or 18-525, if removal only. | Each | 349 |
| 18-529 | Add to item 18-517 to 18-519, 18-524 or 18-526 if removal only. | Each | 658 |
| 18-530 | Add to item 18-520 or 18-527, if removal only. | Each | 1586 |
| | **Water Coolers** | | |
| 18-531 | Electric Water Cooler, SP, 220/240V, cooling capacity 30 to 40 LiUhr, complete, supply and fixing. | Each | 38385 |
| 18-532 | Same as item 18-531, but 60 LiUhr, capacity. | Each | 43785 |
| 18-533 | Same as item 18-531, but 80 LiUhr capacity. | Each | 51998 |
| 18-534 | Same as item 18-531, but 100 LiUhr capacity. | Each | 62198 |
| 18-535 | Same as item 18-531, but 200 LiUhr capacity. | Each | 152250 |
| 18-536 | Same as item 18-531 to 18-532, but fixing only. | Each | 345 |
| 18-537 | Same as item 18-533 to 18-534, but fixing only. | Each | 518 |
| 18-538 | Same as item 18-535 but fixing only. | Each | 690 |
| 18-539 | Add to item 18-531 to 18-532 or 18-536, if removal only. | Each | 259 |
| 18-540 | Add to item 18-533 to 18-534 or 18-537, if removal only. | Each | 388 |
| 18-541 | Add to item 18-535 or 18-538, if removal only. | Each | 518 |
| | **Water Filters** | | |
| 18-542 | Water filter, 3 stage, consisting of polypropylene fiber cartridge 5 micron, granular activated carbon cartridge 1 micron, and size of cartridge 1O" with ultra violet lamp, water flow rate **2 GPM** complete, supply and fixing. | Each | 9906 |
| 1J3-543 | Same as item 18-542, but **3 GPM.** | Each | 16362 |
| 18-544 | Same as item 18-542, but **8 GPM.** | Each | 17086 |
| 18-545 | Same as item 18-542 to 18-544, but fixing only. | Each | 162 |
| 18-546 | Add to item 18-542 to 18-545, if removal only. | Each | 122 |
| | **PE-Pipes** | | |
| 18-547 | **Polyethylene** Pipe (PE-100), 20 mm dia, Class PN-10 / SDR-17 (excluding cost of excavation), supply and fixing. | Metre | 140 |
| 18-548 | Same as item 18-547, but 25 mm dia. | Metre | 146 |
| 18-549 | Same as item 18-547, but 32 mm dia. | Metre | 172 |
| 18-550 | Same as item 18-547, but 40 mm dia. | Metre | 249 |
| 18-551 | Same as item 18-547, but 50 mm dia. | Metre | 321 |
| 18-552 | Same as item 18-547, but 63 mm dia. | Metre | 440 |
| 18-553 | Same as item 18-547, but 75 mm dia. | Metre | 623 |
| 18-554 | Same as item 18-547, but 90 mm dia. | Metre | 821 |
| 18-555 | Same as item 18-547, but 110 mm dia, complete with fusion joint. | Metre | 1090 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18.,556 | Same as item 18-555, but 125 mm dia | Metre | 1356 |
| 18-557 | Same as item 18-555, but 160 mm dia | Metre | 2151 |
| 18-558 | Same as item 18-555, but 180 mm dia | Metre | 2710 |
| 18-559 | Same as item 18-555, but 200 mm dia | Metre | 3316 |
| 18-560 | Same as item 18-555, but 250 mm dia | Metre | 5115 |
| 18-561 | Same as item 18-555, but 280 mm dia | Metre | 6950 |
| 18-562 | Same as item 18-555, but 315 mm dia | Metre | 8850 |
| 18-563 | Same as item 18-555, but 355 mm dia | Metre | 11212 |
| 18-564 | Same as item 18-555, but 400 mm dia | Metre | 14013 |
| 18-565 | Same as item 18-555, but 450 mm dia | Metre | 17533 |
| 18-566 | **Polyethylene** Pipe (PE-100), 20 mm dia, Class PN-12.5/SDR-13.6 (excl cost of excavation), supply and fixing. | Metre | 133 |
| 18-567 | Same as item 18-566, but 25 mm dia. | Metre | 152 |
| 18-568 | Same as item 18-566, but 32 mm dia. | Metre | 188 |
| 18-569 | Same as item 18-566, but 40 mm dia. | Metre | 280 |
| 18-570 | Same as item 18-566, but 50 mm dia. | Metre | 367 |
| 18-571 | Same as item 18-566, but 63 mm dia. | Metre | 515 |
| 18-572 | Same as item 18-566, but 75 mm dia. | Metre | 732 |
| 18-573 | Same as item 18-566, but 90 mm dia. | Metre | 976 |
| 18-574 | Same as item 18-566, but 110 mm dia, complete with fusion joint. | Metre | 1608 |
| 18-575 | Same as item 18-574, but 125 mm dia | Metre | 1953 |
| 18-576 | Same as item 18-574, but 160 mm dia | Metre | 2797 |
| 18-577 | Same as item 18-574, but 180 mm dia | Metre | 3648 |
| 18-578 | Same as item 18-574, but 200 mm dia | Metre | 4377 |
| 18-579 | Same as item 18-574, but 250 mm dia | Metre | 6764 |
| 18-580 | Same as item 18-574, but 280 mm dia | Metre | 10138 |
| 18-581 | Same as item 18-574, but 315 mm dia | Metre | 10921 |
| 18-582 | Same as item 18-574, but 355 mm dia | Metre | 13810 |
| 18-583 | Same as item 18-574, but 400 mm dia | Metre | 17345 |
| 18-584 | Same as item 18-574, but 450 mm dia | Metre | 21744 |
| 18-585 | **Polyethylene** Pipe (PE-100), 20 mm dia Class PN-16 / SDR-11 (excluding cost of excavation), supply and fixing. | Metre | 138 |
| 18-586 | Same as item 18-585, but 25 mm dia. | Metre | 161 |
| 18-587 | Same as item 18-585, but 32 mm dia. | Metre | 212 |
| 18-588 | Same as item 18-585, but 40 mm dia. | Metre | 314 |
| 18-589 | Same as item 18-585, but 50 mm dia. | Metre | 421 |
| 18-590 | Same as item 18-585, but 63 mm dia. | Metre | 598 |
| 18-591 | Same as item 18-585, but 75 mm dia. | Metre | 840 |
| 18-592 | Same as item 18-585, but 90 mm dia. | Metre | 1860 |
| 18-593 | Same as item 18-585, but 110 mm dia complete with fusion joint. | Metre | 2195 |
| 18-594 | Same as item 18-593, but 125 mm dia. | Metre | 2284 |
| 18-595 | Same as item 18-593, but 160 mm dia. | Metre | 3336 |
| 18-596 | Same as item 18-593, but 180 mm dia. | Metre | 4319 |
| 18-597 | Same as item 18-593, but 200 mm dia. | Metre | 5219 |
| 18-598 | Same as item 18-593, but 250 mm dia. | Metre | 8057 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-599 | Same as item 18-593, but 280 mm dia. | Metre | 10420 |
| 18-600 | Same as item 18-593, but 315 mm dia. | Metre | 13074 |
| 18-601 | Same as item 18-593, but 355 mm dia. | Metre | 16551 |
| 18-602 | Same as item 18-593, but 400 mm dia. | Metre | 20840 |
| 18-603 | Same as item 18-593, but 450 mm dia. | Metre | 26187 |
| 18-604 | Same as item 18-547 to 18-549,18-566 to 18-568, 18-585 to 18-587 but fixing only. | Metre | 86 |
| 18-605 | Same as item 18-550 to 18-552, 18-569 to 18-571, 18-588 to 18-590 but fixing only. | Metre | 121 |
| 18-606 | Same as item 18-553 to 18-554, 18-572 to18-573, 18-591 to 18-592 but fixing only. | Metre | 173 |
| 18-607 | Same as item 18-555 to 18-557, 18-574 to18-576, 18-593 to 18-595 but fixing only. | Metre | 421 |
| 18-608 | Same as item 18-558 to 18-559, 18-577 to 18-578, 18-596 to 18-597 but fixing only. | Metre | 458 |
| 18-609 | Same as item 18-560 to 18-562, 18-579 to 18-581, 18-598 to 18-600 but fixing only. | Metre | 632 |
| 18-610 | Same as item 18-563 to 18-565, 18-582 to 18-584, 18-601 to 18-603 but fixing only. | Metre | 839 |
| 18-611 | Add to item 18-547 to 18-549,18-566 to 18-568, 18-585 to 18-587 or 18-604 if removal only. | Metre | 65 |
| 18-612 | Add to item 18-550 to 18-552, 18-569 to 18-571, 18-588 to 18-590 or 18-605 if removal only. | Metre | 91 |
| 18-613 | Add to item 18-553 to 18-554, 18-572 to18-573, 18-591 to 18-592 or 18-606 if removal only. | Metre | 129 |
| 18-614 | Add to item 18-555 to 18-557, 18-574 to18-576, 18-593 to 18-595 or 18-607 if removal only. | Metre | 91 |
| 18-615 | Add to item 18-558 to 18-559, 18-577 to 18-578, 18-596 to 18-597 or 18-608 if removal only. | Metre | 104 |
| 18-616 | Add to item 18-560 to 18-562, 18-579 to 18-581, 18-598 to 18-600 or 18-609 if removal only. | Metre | 129 |
| 18-617 | Add to item 18-563 to 18-565, 18-582 to 18-584, 18-601 to 18-603 or 18-610 if removal only. | Metre | 173 |
| 18-618 | Butt fusion joint 110 mm to 160 mm dia complete. | Each | 1800 |
| 18-619 | Same as item 18-618 but 180 mm to 200 mm dia | Each | 1920 |
| 18-620 | Same as item 18-618 but 225 mm to 315 mm dia | Each | 2760 |
| 18-621 | Same as item 18-618 but 355 mm to 450 mm dia | Each | 3600 |
| | **Coupler/ Socket** | | |
| 18-622 | Coupler/Socket, 20 mm dia, for PE pipe supply and fixing. | Each | 110 |
| 18-623 | Same as item 18-622, but 25 mm dia. | Each | 145 |
| 18-624 | Same as item 18-622, but 32 mm dia. | Each | 195 |
| 18-625 | Same as item 18-622, but 40 mm dia. | Each | 370 |
| 18-626 | Same as item 18-622, but 50 mm dia. | Each | 568 |
| 18-627 | Same as item 18-622, but 63 mm dia. | Each | 896 |
| 18-628 | Same as item 18-622, but 75 mm dia. | Each | 1218 |
| 18-629 | Same as item 18-622, but 90 mm dia. | Each | 2101 |
| 18-630 | Same as item 18-622 but 110 mm dia. | Each | 2306 |

| Sl No. | Description | Unit | Rate(Rs)l |
|---|---|---|---|
| | **Reducing Coupler/ Socket** | | |
| 18-631 | Reducing Coupler/Socket 25 x 20 mm dia, **for PE pipe,** supply and fixing. | Each | 156 |
| 18-632 | Same as item 18-631, but 32 x 20 mm dia. | Each | 185 |
| | Same as item 18-631, but 32 x 25 mm dia. | Each | 206 |
| | Same as item 18-631, but 40 x 25 mm dia. | Each | 323 |
| | Same as item 18-631, but 40 x 32 mm dia. | Each | 355 |
| | Same as item 18-631, but 50 x 25 mm dia. | Each | 335 |
| | Same as item 18-631, but 50 x 32 mm dia. | Each | 469 |
| | Same as item 18-631 but 50 x 40 mm dia. | Each | 559 |
| | Same as item 18-631, but 63 x 32 mm dia. | Each | 670 |
| | Same as item 18-631, but 63 x 50 mm dia. | Each | 872 |
| | Same as item 18-631, but 75 x 50 mm dia or 75 x 63 mm | Each | 890 |
| | Same as item 18-631, but 90 x 63 mm dia or but 90 x 75 mm dia | Each | 908 |
| | Same as item 18-631, but 110 x 63 mm or 110 x 90mm dia, 110 x 75 mm dia. **Butt Fusion fitting.** | Each | 954 |
| 18-644 | Same as item 18-643, but 125 x90 mm or 125mm x 110mm dia. | Each | 1310 |
| 18-645 | Same as item 18-643, but 160 x 90 mm dia or 160 x110 mm dia | Each | 1707 |
| 18-646 | Same as item 18-643, but 160 x 125 mm or 180 x 90 mm dia. | Each | 2060 |
| 18-647 | Same as item 18-643, but 180 x 110mm, 180 x 125 mm or 180 x 160 mm dia. | Each | 3163 |
| 18-648 | Same as item 18-643, but 200 x 160 mm or 200 x 180 mm dia. | Each | 3843 |
| 18-649 | Same as item 18-643 but 200 x 90 mm dia, | Each | 3843 |
| 18-650 | Same as item 18-643, but 200 x 110 mm dia. | Each | 4188 |
| 18-651 | Same as item 18-643, but 200 x 160 mm dia. | Each | 4188 |
| 18-652 | Same as item 18-643 but 250 x 90 mm dia, | Each | 8416 |
| 18-653 | Same as item 18-643 but 250 x 110 mm dia, | Each | 8416 |
| 18-654 | Same as item 18-643 but 250 x 160 mm dia, | Each | 7577 |
| 18-655 | Same as item 18-643, but 250 x 180 mm dia. | Each | 7914 |
| 18-656 | Same as item 18-643 but 250 x 200 mm dia, | Each | 7927 |
| 18-657 | Same as item 18-643 but 280 x 110 mm dia, | Each | 10175 |
| 18-658 | Same as item 18-643 but 280 x 160 mm dia, | Each | 10175 |
| 18-659 | Same as item 18-643 but 280 x 200 mm dia, | Each | 11523 |
| 18-660 | Same as item 18-643 but 315 x 90 mm dia, | Each | 12050 |
| 18-661 | Same as item 18-643 but 315 x 110 mm dia, | Each | 12188 |
| 18-662 | Same as item 18-643 but 315 x 160 mm dia, | Each | 12435 |
| 18-663 | Same as item 18-643 but 315 x 250 mm dia, | Each | 12615 |
| 18-664 | Same as item 18-643 but 355 x 160 mm dia, | Each | 13147 |
| 18-665 | Same as item 18-643 but 400 x 315 mm dia. | Each | 15914 |
| 18-666 | Same as item 18-643 but 450 x 200 mm dia, | Each | 28591 |
| 18-667 | Same as item 18-618 to 18-620, 18-627 to 18-629, but fixing only. | Each | 35 |
| 18-668 | Same as item 18-621 to 18-623, 18-630 to 18-635 but fixing only. | Each | 69 |
| 18-669 | Same as item 18-624 to 18-626, 18-636 to 18-640, but fixing only. | Each | 86 |
| 18-670 | Same as item 18-641 to 18-646, but fixing only. | Each | 121 |
| 18-671 | Same as item 18-647 to 18-651 but fixing only. | Each | 342 |
| 18-672 | Same as item 18-652 to 18-663, but fixing only. | Each | 342 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-673 | Same as item 18-664 to 18-666, but fixing only. | Each | 442 |
| 18-674 | Add to item 18-618 to 18-620, 18-627 to 18-629 or 18-667 if removal only. | Each | 26 |
| 18-675 | Add to item 18-621 to 18-623, ,18-630 to 18-635 or 18-668 if removal only. | Each | 52 |
| 18-676 | Add to item 18-624 to 18-626, 18-636 to 18-640 or 18-669, if removal only. | Each | 65 |
| 18-677 | Add to item 18-641 to 18-646 or 18-670, if removal only. | Each | 91 |
| 18-678 | Add to item 18-647 to 18-651 or 18-671, if removal only. | Each | 138 |
| 18-679 | Add to item 18-652 to 18-663 or 18-672, if removal only. | Each | 173 |
| 18-680 | Add to item 18-664 to 18-666 or 18-673, if removal only. | Each | 206 |
| | **Tee Equal** | | |
| 18-681 | Tee **Equal,** 20 mm dia, for PE pipe, supply and fixing. | Each | 175 |
| 18-682 | Same as item 18-681, but 25 mm dia. | Each | 271 |
| 18-683 | Same as item 18-681, but 32 mm dia. | Each | 354 |
| 18-684 | Same as item 18-681, but 40 mm dia. | Each | 624 |
| 18-685 | Same as item 18-681, but 50 mm dia. | Each | 686 |
| 18-686 | Same as item 18-681, but 63 mm dia. | Each | 830 |
| 18-687 | Same as item 18-681, but 75 mm dia. | Each | 960 |
| 18-688 | Same as item 18-681, but 90 mm dia. | Each | 1256 |
| 18-689 | Same as item 18-681, but 110 mm dia, with Butt Fusion fitting. | Each | 1599 |
| 18-690 | Same as item 18-689, but 125 mm dia. | Each | 2886 |
| 18-691 | Same as item 18-689, but 160 mm dia. | Each | 3504 |
| 18-692 | Same as item 18-689, but 180 mm dia. | Each | 6439 |
| 18-693 | Same as item 18-689, but 200 mm dia | Each | 6518 |
| 18-694 | Same as item 18-689, but 250 mm dia. | Each | 14292 |
| 18-695 | Same as item 18-689, but 280 mm dia. | Each | 27023 |
| 18-696 | Same as Item 18-689, but 315 mm dia. | Each | 28525 |
| 18-697 | Same as Item 18-689, but 355 mm dia. | Each | 34432 |
| 18-698 | Same as Item 18-689, but 400 mm dia. | Each | 48709 |
| 18-699 | Same as Item 18-689, but 450 mm dia. | Each | 79646 |
| | **Reducing Tee** | | |
| 18-700 | Reducing Tee 25 x 20 mm dia for **PE pipe,** supply and fixing. | Each | 297 |
| 18-701 | Same as item 18-700, but 32 x 20 mm dia. | Each | 316 |
| 18-702 | Same as item 18-700, but 32 x 25 mm dia. | Each | 324 |
| 18-703 | Same as item 18-700, but 40 x 32 mm dia. | Each | 526 |
| 18-704 | Same as item 18-700, but 50 x 25 mm dia. | Each | 849 |
| 18-705 | Same as item 18-700, but 50 x 32 mm dia. | Each | 907 |
| 18-706 | Same as item 18-700, but 50 x 40 mm dia. | Each | 977 |
| 18-707 | Same as item 18-700, but 63 x 32 mm dia. | Each | 1398 |
| 18-708 | Same as item 18-700, but 63 x 50 mm dia. | Each | 1486 |
| 18-709 | Same as item 18-700, but 75 x 63 mm dia. | Each | 1723 |
| 18-710 | Same as item 18-700, but 90 x 63 mm dia. | Each | 1891 |
| 18-711 | Same as item 18-700, but 90 x 75 mm dia. | Each | 2083 |
| 18-712 | Same as item 18-700 but 125 x 90 mm dia, with Butt Fusion fitting. | Each | 2552 |
| 18-713 | Same as item 18-712, but 160 x 90 mm dia. | Each | 3027 |
| 18-714 | Same as item 18-712, but 160 x110 mm dia. | Each | 3027 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-715 | Same as item 18-712, but 180 x 125 mm dia. | Each | 5329 |
| 18-716 | Same as item 18-712, but 200 x 90 mm dia. | Each | 8162 |
| 18-717 | Same as item 18-712, but 200 x 110 mm dia. | Each | 8372 |
| 18-718 | Same as item 18-712, but 200 x 160 mm dia. | Each | 8558 |
| 18-719 | Same as item 18-712, but 250 x 90 mm dia. | Each | 12968 |
| 18-720 | Same as item 18-712, but 250 x 110 mm dia. | Each | 12968 |
| 18-721 | Same as item 18-712, but 250 x 160 mm dia. | Each | 14556 |
| 18-722 | Same as item 18-712, but 250 x 200 mm dia. | Each | 14556 |
| 18-723 | Same as item 18-712, but 280 x 110 mm dia. | Each | 15761 |
| 18-724 | Same as item 18-712, but 280 x 250 mm dia. | Each | 18569 |
| 18-725 | Same as item 18-712, but 315 x 90 mm dia. | Each | 19314 |
| 18-726 | Same as item 18-712, but 315 x 110 mm dia. | Each | 19314 |
| 18-727 | Same as item 18-712, but 315 x 160 mm dia. | Each | 21298 |
| 18-728 | Same as item 18-712, but 315 x 250 mm dia. | Each | 21298 |
| 18-729 | Same as item 18-712, but 355 x 160 mm dia. | Each | 25660 |
| 18-730 | Same as item 18-712, but 355 x 250 mm dia. | Each | 32845 |
| 18-731 | Same as item 18-712, but 400 x 110 mm dia. | Each | 32845 |
| 18-732 | Same as item 18-712, but 400 x 315 mm dia. | Each | 47917 |
| 18-733 | Same as item 18-712, but 450 x 160 mm dia. | Each | 47917 |
| 18-734 | Same as item 18-712, but 450 x 250 mm dia. | Each | 63781 |
| 18-735 | Same as item 18-681 to 18-683, 18-700 to 18-703,but fixing only. | Each | 52 |
| 18-736 | Same as item 18-684 to 18-686 or 18-704 to 18-707, but fixing only. | Each | 86 |
| 18-737 | Same as item 18-687 to 18-688 or 18-708 to 18-711, but fixing only. | Each | 104 |
| 18-738 | Same as item 18-689 to 18-691 or 18-712 to 18-714, but fixing only. | Each | 173 |
| 18-739 | Same as item 18-692 to 18-693 or 18-715 to 18-718, but fixing only. | Each | 690 |
| 18-740 | Same as item 18-694 to 18-695 or 18-719 to 18-728, but fixing only. | Each | 690 |
| 18-741 | Same as item 18-696 to 18-699 or 18-729 to 18-734, but fixing only. | Each | 690 |
| 18-742 | Add to item 18-681 to 18-683, 18-700 to 18-703, or 18-735 if removal only. | Each | 39 |
| 18-743 | Add to item 18-684 to 18-686, 18-704 to 18-707 or 18-736 if removal only. | Each | 65 |
| 18-744 | Add to item 18-687 to 18-688, 18-708 to 18-711 or 18-737 if removal only. | Each | 78 |
| 18-745 | Add to item 18-689 to 18-691, 18-712 to 18-714 or 18-738 if removal only. | Each | 129 |
| 18-746 | Add to item 18-692 to 18-693, 18-715 to 18-718 or 18-739 if removal only. | Each | 345 |
| 18-747 | Add to item 18-694 to 18-695, 18-719 to 18-728 or 18-740 if removal only. | Each | 345 |
| 18-748 | Add to item 18-696 to 18-699, 18-729 to 18-734 or 18-741 if removal only. | Each | 345 |
| | **Male/ Female Tee** | | |
| 18-749 | Male /Female Tee 20 mm x 15mm dia, for PE pipe, Supply and Fixing. | Each | 196 |
| 18-750 | Same as item 18-749, but 20 x 20 mm dia. | Each | 217 |
| 18-751 | Same as item 18-749, but 25 x 25 mm dia. | Each | 288 |
| 18-752 | Same as item 18-749, but 25 x 20 mm dia. | Each | 281 |
| 18-753 | Same as item 18-749, but 32 x 25 mm dia | Each | 421 |
| 18-754 | Same as item 18-749, but 32 x 20 mm dia | Each | 329 |
| 18-755 | Same as item 18-749, but 50 x 32 mm dia. | Each | 802 |
| 18-756 | Same as item 18-749, but 50 x 40 mm dia. | Each | 1025 |
| 18-757 | Same as item 18-749, but 63 x 50 mm dia. | Each | 1415 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-758 | Same as item 18-749, but 90 x 75 mm dia. | Each | 2792 |
| 18-759 | Same as item 18-749 to 18-752, but fixing only. | Each | 52 |
| 18-760 | Same as item 18-753 to 18-756, but fixing only. | Each | 86 |
| 18-761 | Same as item 18-757 to 18-758, but fixing only. | Each | 104 |
| 18-762 | Add to item 18-749 to 18-752 or 18-759, if removal only. | Each | 39 |
| 18-763 | Add to item 18-753 to 18-756 or 18-760, if removal only. | Each | 65 |
| 18-764 | Add to item 18-757 to 18-758 or 18-761, if removal only. | Each | 78 |
| | **Bend** | | |
| 18-765 | Bend 20 mm dia for PE pipe, supply and fixing. | Each | 121 |
| 18-766 | Same as item 18-765, but 25 mm dia. | Each | 171 |
| 18-767 | Same as item 18-765, but 32 mm dia. | Each | 225 |
| 18-768 | Same as item 18-765, but 40 mm dia. | Each | 430 |
| 18-769 | Same as item 18-765, but 50 mm dia. | Each | 663 |
| 18-770 | Same as item 18-765, but 63 mm dia. | Each | 1047 |
| 18:..111 | Same as item 18-765, but 75 mm dia. | Each | 1641 |
| 18-772 | Same as item 18-765, but 90 mm dia. | Each | 1982 |
| | **Elbow** | | |
| 18-773 | Elbow, 110 mm dia, for PE pipe, with Butt Fusion joint, supply and fixing. | Each | 1196 |
| 18-714 | Same as item 18-773, but 125 mm dia. | Each | 2588 |
| 18-775 | Same as item 18-773, but 160 mm dia. | Each | 2738 |
| 18-776 | Same as item 18-773, but 180 mm dia. | Each | 4483 |
| 18-777 | Same as item 18-773, but 200 mm dia. | Each | 5038 |
| 18-778 | Same as item 18-773, but 250 mm dia. | Each | 8449 |
| 18-779 | Same as item 18-773, but 280 mm dia | Each | 18673 |
| 18-780 | Same as Item18-773, but 315 mm dia | Each | 20267 |
| 18-781 | Same as Item18-773, but 355 mm dia | Each | 26501 |
| 18-782 | Same as Item18-773, but 400 mm dia | Each | 34432 |
| 18-783 | Same as Item18-773, but 450 mm dia | Each | 47124 |
| | **Male/ Female Bend** | | |
| 18-784 | Male/ Female Bend, 20 x 15 mm dia, for PE pipe, supply and fixing | Each | 93 |
| 18-785 | Same as item 18-784, but 20 x 20 mm dia | Each | 133 |
| 18-786 | Same as item 18-784, but 25 x 25 mm dia | Each | 129 |
| 18-787 | Same as item 18-784, but 25 x 20 mm dia | Each | 196 |
| 18-788 | Same as item 18-784, but 25 x 15 mm dia | Each | 129 |
| 18-789 | Same as item 18-784, but 32 x 20 mm dia | Each | 193 |
| 18-790 | Same as item 18-784, but 32 x 25 mm dia | Each | 249 |
| 18-791 | Same as item 18-784, but 40 x 32 mm dia | Each | 434 |
| 18-792 | Same as item 18-784, but 50 x 32 mm dia | Each | 499 |
| 18-793 | Same as item 18-784, but 50 x 40 mm dia | Each | 536 |
| 18-794 | Same as item 18-784, but 63 x 50 mm dia | Each | 722 |
| 18-795 | Same as item 18-784, but 90 x 75 mm dia | Each | 2069 |
| 18-796 | Same as item 18-765 to 18-767, 18-784 to 18-787, but fixing only. | Each | 35 |
| 18-797 | Same as item 18-768 to 18-770, 18-788 to 18-791, but fixing only. | Each | 69 |
| 18-798 | Same as item 18-771 to 18-772, 18-792 to 18-795, but fixing only. | Each | 86 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-799 | Same as item 18-773 to 18-775, but fixing only. | Each | 121 |
| 18-800 | Same as item 18-776 to 18-777, but fixing only. | Each | 121 |
| 18-801 | Same as item 18-778 to 18-780, but fixing only. | Each | 12·1 |
| 18-802 | Same as item 18-781 to 18-783, but fixing only. | Each | 690 |
| 18-803 | Add to item 18-765 to 18-767, 18-784 to 18-787 or 18-796 if removal only. | Each | 26 |
| 18-804 | Add to item 18-768 to 18-770, 18-788 to 18-791, or 18-797 if removal only. | Each | 52 |
| 18-805 | Add to item 18-771 to 18-772, 18-792 to 18-795, or 18-798 if removal only. | Each | 65 |
| 18-806 | Add to item 18-773 to 18-775, or 18-799 if removal only. | Each | 91 |
| 18-807 | Add to item 18-776 to 18-777, or 18-800 if removal only. | Each | 93 |
| 18-808 | Add to item 18-778 to 18-780, or 18-801 if removal only. | Each | 93 |
| 18-809 | Add to item 18-781 to 18-783, or 18-802 if removal only. | Each | 518 |
| | **Male Threaded Adapter** | | |
| 18-810 | Male Threaded Adapter, 20 x 15 mm dia, for PE pipe, supply and fixing. | Each | 106 |
| 18-811 | Same as item 18-810, but 20 x 20 mm dia. | Each | 109 |
| 18-812 | Same as item 18-810, but 25 x 25 mm dia | Each | 141 |
| 18-813 | Same as item 18-810, but 25 x 20 mm dia. | Each | 135 |
| 18-814 | Same as item 18-810, but 25 x 15 mm dia | Each | 171 |
| 18-815 | Same as item 18-810, but 32 x 15 mm dia | Each | 198 |
| 18-816 | Same as item 18-810, but 32 x 20 mm dia | Each | 201 |
| 18-817 | Same as item 18-810, but 32 x 25 mm dia | Each | 204 |
| 18-818 | Same as item 18-810, but 40 x 25 mm dia | Each | 273 |
| 18-819 | Same as item 18-810, but 40 x 32 mm dia | Each | 288 |
| 18-820 | Same as item 18-810, but 40 x 40 mm dia | Each | 291 |
| 18-821 | Same as item 18-810, but 50 x 32 mm dia | Each | 425 |
| 18-822 | Same as item 18-810, but 50 x 40 mm dia | Each | **428** |
| 18-823 | Same as item 18-810, but 63 x 50 mm dia. | Each | 641 |
| 18-824 | Same as item 18-810, but 75 x 63 mm dia. | Each | 905 |
| 18-825 | Same as item 18-810, but 90 x 75 mm dia. | Each | 1306 |
| 18-826 | Same as item 18-810, but 110 x100 mm dia. | Each | 2266 |
| | **Female Threaded Adapter** | | |
| 18-827 | Female Threaded Adapter, 20 x 15 mm dia, for PE pipe, supply and fixing. | Each | 145 |
| 18-828 | Same as item 18-827, but 20 x 20 mm dia. | Each | 149 |
| 18-829 | Same as item 18-827, but 25 x 25 mm dia | Each | 172 |
| 18-830 | Same as item 18-827, but 25 x 20 mm dia | Each | 169 |
| 18-831 | Same as item 18-827, but 25 x 15 mm dia | Each | 200 |
| 18-832 | Same as item 18-827, but 32 x 20 mm dia | Each | 236 |
| 18-833 | Same as item 18-827, but 32 x 25 mm dia | Each | 242 |
| 18-834 | Same as item 18-827, but 40 x 25 mm dia | Each | 348 |
| 18-835 | Same as item 18-827, but 40 x 32 mm dia | Each | 91 |
| 18-836 | Same as item 18-827, but 50 x 32 mm dia | Each | 416 |
| 18-837 | Same as item 18-827, but 50 x 40 mm dia | Each | 530 |
| 18-838 | Same as item 18-827, but 63 x 50 mm dia | Each | 765 |
| 18-839 | Same as item 18-827, but 75 x 63 mm dia | Each | 1035 |
| 18-840 | Same as item 18-827, but 90 x 75 mm dia | Each | 1661 |

| Sl No. | Description | Unit | Rate(Rs)l. |
|---|---|---|---|
| 18-841 | Same as item 18-810 to 18-813, 18-827 to 18-830, but fixing only | Each | 52 |
| 18-842 | Same as item 18-814 to 18-818, 18-831 to 18-834, but fixing only | Each | 86 |
| 18-843 | Same as item 18-819 to 18-826, 18-835 to 18-840, but fixing only | Each | 104 |
| 18-844 | Add to item 18-810 to 18-813, 18-827 to 18-830 or 18-841, if removal only | Each | 39 |
| 18-845 | Add to item 18-814 to 18-818, 18-831 to 18-834 or 18-842 if removal only | Each | 65 |
| 18-846 | Add to item 18-819 to 18-826, 18-835 to 18-840 or 18-843, if removal only | Each | 78 |
| | **Flange Adapter PE** | | |
| 18-847 | Flange Adapter stub end with steel ring, rubber packing, Nut bolts etc 50 mm dia for PE Pipe, Supply & Fixing | Each | 821 |
| 18-848 | Same as Item 18-847 but 63 mm dia. | Each | 981 |
| 18-849 | Same as Item 18-847 but 75 mm dia. | Each | 1084 |
| 18-850 | Same as Item 18-847 but 90 mm dia. | Each | 1156 |
| 18-851 | Same as Item 18-847 but 110 mm dia. | Each | 1636 |
| 18-852 | Same as Item 18-847 but 125 mm dia. | Each | 2131 |
| 18-853 | Same as Item 18-847 but 160 mm dia. | Each | 2488 |
| 18-854 | Same as Item 18-847 but 180 mm dia. | Each | 3636 |
| 18-855 | Same as Item 18-847 but 200 mm dia. | Each | 4338 |
| 18-856 | Same as Item 18-847 but 250 mm dia. | Each | 5677 |
| 18-857 | Same as Item 18-847 but 280 mm dia. | Each | 7105 |
| 18-858 | Same as Item 18-847 but 315 mm dia. | Each | 7535 |
| 18-859 | Same as Item 18-847 but 355 mm dia. | Each | 9939 |
| 18-860 | Same as Item 18-847 but 400 mm dia. | Each | 13940 |
| 18-861 | Same as Item 18-847 but 450 mm dia. | Each | 17907 |
| 18-862 | Same as item 18-847 to 18-850 but fixing only. | Each | 584 |
| 18-863 | Same as item 18-851 to 18-853 but fixing only. | Each | 1021 |
| 18-864 | Same as item 18-854 to 18-855 but fixing only. | Each | 1098 |
| 18-865 | Same as item 18-856 to 18-858 but fixing only. | Each | 1553 |
| 18-866 | Same as item 18-859 to 18-861 but fixing only. | Each | 2007 |
| 18-867 | Add to item 18-847 to 18-850, or 18-862, if removal only. | Each | 78 |
| 18-868 | Add to item 18-851 to 18-853, or 18-863, if removal only. | Each | 90 |
| 18-869 | Add to item 18-854 to 18-855, or 18-864, if removal only. | Each | 104 |
| 18-870 | Add to item 18-856 to 18-858, or 18-865, if removal only. | Each | 129 |
| 18-871 | Add to item 18-859 to 18-861, or 18-866, if removal only. | Each | 155 |
| | **End Cap** | | |
| 18-872 | End Cap 20 mm dia, for **PE pipe,** supply and fixing. | Each | 92 |
| 18-873 | Same as item 18-872, but 25 mm dia. | Each | 113 |
| 18-874 | Same as item 18-872, but 32 mm dia. | Each | 139 |
| 18-875 | Same as item 18-872, but 40 mm dia. | Each | 229 |
| 18-876 | Same as item 18-872, but 50 mm dia. | Each | 370 |
| 18-877 | Same as item 18-872, but 63 mm dia. | Each | 473 |
| 18-878 | Same as item 18-872, but 75 mm dia. | Each | 494 |
| 18-879 | Same as item 18-872, but 90 mm dia. | Each | 524 |
| 18-880 | Same as item 18-872, but 110 mm dia. | Each | 545 |
| 18-881 | Same as item 18-872, but 125 mm dia Butt Fusion fitting. | Each | 1038 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-882 | Same as item 18-881, but 160 mm dia. | Each | 1196 |
| 18-883 | Same as item 18-881, but 180 mm dia. | Each | 1435 |
| 18-884 | Same as item 18-881, but 200 mm dia. | Each | 1886 |
| 18-885 | Same as item 18-872 to 18-874, but fixing only. | Each | 35 |
| 18-886 | Same as item 18-875 to 18-877, but fixing only. | Each | 52 |
| 18-887 | Same as item 18-878 to 18-880, but fixing only. | Each | 69 |
| 18-888 | Same as item 18-881 to 18-884, but fixing only. | Each | 86 |
| 18-889 | Add to item 18-872 to 18-874 or 18-885, if removal only. | Each | 26 |
| 18-890 | Add to item 18-875 to 18-877 or 18-886, if removal only. | Each | 39 |
| 18-891 | Add to item 18-878 to 18-880 or 18-887, if removal only. | Each | 52 |
| 18-892 | Add to item 18-881 to 18-884 or 18-888, if removal only. | Each | 65 |
| | **PPR (Poly Propylene Random)- Pipes** | | |
| 18-893 | **PPR pipe,** with all fittings i.e. socket, bend, tee, elbow, where required, 20 mm dia, Class PN-20 (excluding excavation), supply and fixing. | Metre | 239 |
| 18-894 | Same as item 18-893, but 25 mm dia. | Metre | 259 |
| 18-895 | Same as item 18-893, but 32 mm dia. | Metre | 379 |
| 18-896 | Same as item 18-893, but 40 mm dia. | Metre | 589 |
| 18-897 | Same as item 18-893, but 50 mm dia. | Metre | 946 |
| 18-898 | Same as item 18-893 but 63 mm dia. | Metre | 1390 |
| 18-899 | Same as item 18-893, but 75 mm dia. | Metre | 2322 |
| 18-900 | Same as item 18-893, but 90 mm dia. | Metre | 3351 |
| 18-901 | Same as item 18-893, but 110 mm dia. | Metre | 4205 |
| 18-902 | Same as item 18-893 to 18-895, but fixing only. | Metre | 86 |
| 18-903 | Same as item 18-896 to 18-898, but fixing only. | Metre | 121 |
| 18-904 | Same as item 18-899 to 18-901, but fixing only. | Metre | 173 |
| 18-905 | Add to item 18-893 to 18-895 or 18-902, if removal only. | Metre | 65 |
| 18-906 | Add to item 18-896 to 18-898 or 18-903, if removal only. | Metre | 91 |
| 18-907 | Add to item 18-899 to 18-901 or 18-904, if removal only. | Metre | 129 |
| | **Coupler / Socket** | | |
| 18-908 | **PPR Coupler/** Socket, 20 mm dia, supply and fixing. | Each | 55 |
| 18-909 | Same as item 18-908, but 25 mm dia. | Each | 54 |
| 18-910 | Same as item 18-908, but 32 mm dia. | Each | 68 |
| 18-911 | Same as item 18-908, but 40 mm dia. | Each | 127 |
| 18-912 | Same as item 18-908, but 50 mm dia. | Each | 185 |
| 18-913 | Same as item 18-908, but 63 mm dia. | Each | 280 |
| 18-914 | Same as item 18-908, but 75 mm dia. | Each | 553 |
| 18-915 | Same as item 18-908, but 90 mm dia. | Each | 957 |
| 18-916 | Same as item 18-908, but 110 mm dia | Each | 1417 |
| | **Reducing Coupler/ Socket** | | |
| 18-917 | **PPR Reducing Coupler/** Socket 25 x 20 mm dia, supply and fixing. | Each | 65 |
| 18-918 | Same as item 18-917, but 32 x 20 mm dia. | Each | 73 |
| 18-919 | Same as item 18-917, but 32 x 25 mm dia. | Each | 80 |
| 18-920 | Same as item 18-917, but 40 x 20 mm, 40 x 25 mm or40 x 32 mm dia. | Each | 153 |
| 18-921 | Same as item 18-917, but 50 x 25 mm, 50 x 32 mm or 50 x 40 mm dia. | Each | 154 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| | Same as item 18-917, but 63 x 25 mm dia. | Each | 202 |
| | Same as item 18-917, but 63 x 35 mm, 63 x 40 mm or 63 x 50 mm dia. | Each | 312 |
| | Same as item 18-917, but 75 x 63 mm dia. | Each | 1622 |
| | Same as item 18-917, but 90 x 63 mm or 90 x 75mm dia. | Each | 1622 |
| | Same as item 18-917, but 110 x 90 mm dia. | Each | 2146 |
| | Same as item 18-908 to 18-910, 18-917 to 18-919, but fixing only. | Each | 35 |
| | Same as item 18-911 to 18-913, 18-920 to 18-922, but fixing only. | Each | 69 |
| | Same as item 18-914 to 18-916, 18-923 to 18-926, but fixing only. | Each | 86 |
| | Add to item 18-908 to 18-910, 18-917 to 18-919 or 18-927, if removal only. | Each | 26 |
| | Add to item 18-911 to 18-913, 18-920 to 18-922 or 18-928, if removal only. | Each | 52 |
| | Add to item 18-914 to 18-916, 18-923 to 18-926 or 18-929, if removal only. | Each | 65 |
| | **Tee Equal** | | |
| | **Tee Equal,** 20 mm dia for **PPR piµe,** supply and fixing. | Each | 9 1 |
| | Same as item 18-933, but 25 mm dia. | Each | 85 |
| | Same as item 18-933, but 32 mm dia. | Each | 115 |
| | Same as item 18-933, but 40 mm dia. | Each | 187 |
| | Same as item 18-933, but 50 mm dia. | Each | 345 |
| | Same as item 18-933, but 63 mm dia. | Each | 572 |
| | Same as item 18-933, but 75 mm dia. | Each | 1222 |
| | Same as item 18-933, but 90 mm dia. | Each | 2000 |
| | Same as item 18-933, but 110 mm dia. | Each | 3274 |
| | **Reducing Tee** | | |
| | **Reducing Tee,** 25mm x 20mm x 25mm dia for **PPR pipe,** supply and fixing. | Each | 83 |
| | Same as item 18-942, but 32 x 20 x 32mm dia. | Each | 123 |
| | Same as item 18-942, but 32 x 25 x 32mm dia. | Each | 150 |
| | Same as item 18-942, but 40 x 20 x 40 mm, 40 x 25 x 40 mm or40 x 32 x 40 mm dia. | Each | 192 |
| | Same as item 18-942, but 50 x 25 x 50 mm, 50 x 32 x 50 mm or 50 x 40 x 50 mmdia. | Each | 455 |
| | Same as item 18-942, but 63 x 25 x 63 mm dia. | Each | 698 |
| | Same as item 18-942, but 63 x 32 x 63 mm dia. | Each | 712 |
| Same as item 18-942, but 63 x 40 x 63 mm or 63 x 50 x 63 mm dia. | | Each | 741 |
| Same as item 18-942 but 75 x 63 x 75 mm dia. | | Each | 1307 |
| | Same as item 18-933 to 18-935, 18-942 to 18-944, but fixing only. | Each | 52 |
| | Same as item 18-936 to 18-938, 18-945 to 18-946, but fixing only. | Each | 86 |
| | Same as item 18-939 to 18-941, 18-947 to 18-950, but fixing only. | Each | 104 |
| | Add to item 18-933 to 18-935, 18-942 to 18-944 or 18-951, if removal only. | Each | 39 |
| | Add to item 18-936 to 18-938, 18-945 to 18-946 or 18-952 if removal only. | Each | 65 |
| | Add to item 18-939 to 18-941, 18-947 to 18-950 or 18-953, if removal only. | Each | 78 |
| | **Male Threaded -Tee** | | |
| | **Male Threaded Tee,** 20 mm x 15 mm dia for **PPR pipe,** supply and fixing. | Each | 335 |
| | Same as item 18-957, but 20 x 20 mm dia. | Each | 507 |
| | Same as item 18-957, but 25 x 15 mm dia. | Each | 245 |
| | Same as item 18-957, but 25 x 20 mm dia. | Each | 322 |
| | Same as item 18-957, but 32 x 20 mm dia. | Each | 372 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-962 | Same as item 18-957, but 32 x 25 mm dia. | Each | 509 |
| | **Female Threaded -Tee** | | |
| 18-963 | **Female Threaded Tee,** 20 mm x 15 mm dia for **PPR pipe,** supply and fixing. | Each | 210 |
| 18-964 | Same as item 18-963, but 20 x 20 mm dia. | Each | 253 |
| 18-965 | Same as item 18-963, but 25 x 15 mm dia. | Each | 195 |
| 18-966 | Same as item 18-963, but 25 x 20 mm dia. | Each | 243 |
| 18-967 | Same as item 18-963, but 32 x 20 mm dia. | Each | 335 |
| 18-968 | Same as item 18-963 but 32 x 25 mm dia. | Each | 425 |
| 18-969 | Same as item 18-957 to18-960, 18-963 to 18-966, but fixing only. | Each | 52 |
| 18-970 | Same as item 18-961 to18-962, 18-967 to 18-968, but fixing only. | Each | 86 |
| 18-971 | Add to item 18-957 to18-960, 18-963 to 18-966 or 18-969, if removal only. | Each | 39 |
| 18-972 | Add to item 18-961 to18-962, 18-967 to 18-968 or 18-970, if removal only. | Each | 65 |
| | **Elbow** | | |
| 18-973 | **Elbow** 20mm dia 90° for **PPR pipe,** supply and fixing. | Each | 60 |
| 18-974 | Same as item 18-973, but 25 mm dia. | Each | 62 |
| 18-975 | Same as item 18-973, but 32 mm dia. | Each | 84 |
| 18-976 | Same as item 18-973, but 40 mm dia. | Each | 151 |
| 18-977 | Same as item 18-973, but 50 mm dia. | Each | 277 |
| 18-978 | Same as item 18-973, but 63 mm dia. | Each | 471 |
| 18-979 | Same as item 18-973, but 75 mm dia. | Each | 992 |
| 18-980 | Same as item 18-973, but 90 mm dia. | Each | 1891 |
| 18-981 | Same as item 18-973, but 110 mm dia. | Each | 2705 |
| 18-982 | **Elbow** 20 mm dia, 45° for **PPR pipe,** supply and fixing. | Each | 62 |
| 18-983 | Same as item 18-982, but 25 mm dia. | Each | 84 |
| 18-984 | Same as item 18-982, but 32 mm dia. | Each | 87 |
| 18-985 | Same as item 18-982, but 40 mm dia. | Each | 151 |
| 18-986 | Same as item 18-982, but 50 mm dia. | Each | 277 |
| 18-987 | Same as item 18-982, but 63 mm dia. | Each | 471 |
| 18-988 | Same as item 18-982, but 75 mm dia. | Each | 865 |
| 18-989 | Same as item 18-982, but 90 mm dia. | Each | 1572 |
| | **Male Threaded - 90° Elbow** | | |
| 18-990 | **Male Threaded** 90° Elbow, 20 x 15 mm dia for **PPR pipe,** supply and fixing. | Each | 257 |
| 18-991 | Same as item 18-990, but 20 x 20 mm dia. | Each | 300 |
| 18-992 | Same as item 18-990, but 25 x 15 mm dia. | Each | 330 |
| 18-993 | Same as item 18-990, but 25 x 20 mm dia. | Each | 340 |
| 18-994 | Same as item 18-990, but 32 x 20 mm dia. | Each | 355 |
| 18-995 | Same as item 18-990, but 32 x 25 mm dia. | Each | 491 |
| | **Female Threaded - 90° Elbow** | | |
| 18-996 | **Female Threaded** 90° Elbow, 20 x 15 mm dia, for PPR pipe, supply and fixing | Each | 187 |
| 18-997 | Same as item 18-996, but 20 x 20 mm dia. | Each | 237 |
| 18-998 | Same as item 18-996, but 25 x 15 mm dia. | Each | 162 |
| 18-999 | Same as item 18-996, but 25 x 20 mm dia. | Each | 233 |

| Sl No. | Description | Unit | Rate(Rs)l |
|---|---|---|---|
| 18-1000 | Same as item 18-996 but 32 x 20 mm dia. | Each | 317 |
| 18-1001 | Same as item 18-996 but 32 x 25 mm dia. | Each | 398 |
| 18-1002 | Same as item 18-973 to 18-975, 18-982 to 18-984, 18-990 to 18-992, or 18-996 to 18-998, but fixing only. | Each | 35 |
| 18-1003 | Same as item 18-976 to 18-978, 18-985 to 18-987, 18-993 to 18-995 or 18-999 to 18-1001, but fixing only. | Each | 69 |
| 18-1004 | Same as item 18-979 to 18-981 or 18-988 to 18-989, but fixing only | Each | 86 |
| 18-1005 | Add to item 18-973 to 18-975, 18-982 to 18-984, 18-990 to 18-992, 18-996 to 18-998 or 18-1002, if removal only. | Each | 26 |
| 18-1006 | Add to item 18-976 to 18-978, 18-985 to 18-987, 18-993 to18-995, 18-999 to 18-1001 or 18-1003, if removal only. | Each | 52 |
| 18-1007 | Add to item 18-979 to 18-981, 18-988 to 18-989 or 18-1004, if removal only. | Each | 65 |
| | **Ball Tap With Handle** | | |
| 18-1008 | **Ball Tap** with handle, 20 mm dia for **PPR pipe,** supply and fixing. | Each | 541 |
| 18-1009 | Same as item 18-1008, but 25 mm dia. | Each | 689 |
| 18-1010 | Same as item 18-1008, but 32 mm dia. | Each | 1125 |
| 18-1011 | Same as item 18-1008, but 40 mm dia. | Each | 2015 |
| 18-1012 | Same as item 18-1008, but 50 mm dia. | Each | 4735 |
| 18-1013 | Same as item 18-1008, but 63 mm dia. | Each | 4831 |
| | **Screw Tap With Handle** | | |
| 18-1014 | **Screw tap with handle,** 20 mm dia for **PPR pipe,** supply and fixing. | Each | 786 |
| 18-1015 | Same as item 18-1014, but 25 mm dia. | Each | 805 |
| 18-1016 | Same as item 18-1014, but 32 mm dia. | Each | 1175 |
| 18-1017 | Same as item 18-1014, but 40 mm dia. | Each | 1993 |
| 18-1018 | Same as item 18-1014, but 50 mm dia. | Each | 5348 |
| 18-1019 | Same as item 18-1014, but 63 mm dia. | Each | 7389 |
| 18-1020 | Same as item 18-1008 to 18-1010 or 18-1014 to 18-1016, but fixing only. | Each | 35 |
| 18-1021 | Same as item 18-1011 to 18-1013 or 18-1017 to 18-1019, but fixing only. | Each | 69 |
| 18-1022 | Add to item 18-1008 to 18-1010, 18-1014 to 18-1016 or 18-1020, if removal only. | Each | 26 |
| 18-1023 | Add to item 18-1011 to 18-1013, 18-1017 to 18-1019 or 18-1021, if removal only. | Each | 52 |
| | **Male Threaded - Adapter** | | |
| 18-1024 | **Male Threaded Adaptor,** 20 x 15 mm dia for **PPR pipe,** supply and fixing. | Each | 196 |
| 18-1025 | Same as item 18-1024, but 20 x 20 mm dia. | Each | 208 |
| 18-1026 | Same as item 18-1024, but 25 x 15 mm dia. | Each | 221 |
| 18-1027 | Same as item 18-1024, but 25 x 20 mm dia. | Each | 263 |
| 18-1028 | Same as item 18-1024, but 32 x 20 mm dia. | Each | 345 |
| 18-1029 | Same as item 18-1024, but 32 x 25 mm dia. | Each | 467 |
| 18-1030 | Same as item 18-1024, but 40 x 32 mm dia. | Each | 1225 |
| 18-1031 | Same as item 18-1024, but 50 x 40 mm dia. | Each | 1914 |
| 18-1032 | Same as item 18-1024, but 63 x 50 mm dia. | Each | 3062 |
| 18-1033 | Same as item 18-1024, but 63 x 40 mm dia. | Each | 2368 |
| | **Female Threaded - Adapter** | | |
| 18-1034 | **Female Threaded Adaptor,** 20 x 15 mm dia for **PPR pipe,** supply and fixing. | Each | 193 |
| 18-1035 | Same as item 18-1034, but 20 x 20 mm dia. | Each | 239 |

| Sl No. | Description | Unit | Rate(Rs) |
|---|---|---|---|
| 18-1036 | Same as item 18-1034, but 25 x 15 mm dia. | Each | 174 |
| 18-1037 | Same as item 18-1034, but 25 x 20 mm dia. | Each | 205 |
| 18-1038 | Same as item 18-1034, but 32 x 25 mm dia. | Each | 387 |
| 18-1039 | Same as item 18-1034, but 40 x 32 mm dia. | Each | 642 |
| 18-1040 | Same as item 18-1034, but 50 x 40 mm dia. | Each | 1196 |
| 18-1041 | Same as item 18-1034, but 63 x 50 mm dia. | Each | 1953 |
| 18-1042 | Same as item 18-1034, but 63 x 40 mm dia. | Each | 1464 |
| 18-1043 | Same as item 18-1034, but 75 x 63 mm dia. | Each | 2732 |
| 18-1044 | Same as item 18-1024 to 18-1027, 18-1034 to 18-1037, but fixing only. | Each | 52 |
| 18-1045 | Same as item 18-1028 to 18-1031, 18-1038 to 18-1040, but fixing only. | Each | 86 |
| 18-1046 | Same as item 18-1032 to 18-1033 or 18-1041, 18-1043 but fixing only. | Each | 104 |
| 18-1047 | Add to item 18-1024 to 18-1027, 18-1034 to 18-1037 or 18-1044, if removal only. | Each | 39 |
| 18-1048 | Add to item 18-1028 to 18-1031, 18-1038 to 18-1040 or 18-1045, if removal only. | Each | 65 |
| 18-1049 | Add to item 18-1032 to 18-1033, 18-1041 to 18-1043, or 18-1046 if removal only. | Each | 78 |
| 18-1050 | **Cross piece,** 20 mm dia for **PPR pipe,** supply and fixing. | Each | 113 |
| 18-1051 | Same as item 18-1050, but 25 mm dia. | Each | 129 |
| 18-1052 | Cross Tee, 20 mm dia for **PPR pipe,** supply and fixing | Each | 129 |
| 18-1053 | Same as Item 18-1052 but 25 mm dia. | Each | 161 |
| 18-1054 | Same as Item 18-1052 but 32 mm dia. | Each | 214 |
| | **Shut Off Valve with Handle** | | |
| 18-1055 | **Shut off valve with handle,** 20 mm dia for **PPR pipe,** supply and fixing. | Each | 3189 |
| 18-1056 | Same as item 18-1055, but 25 mm dia. | Each | 5032 |
| 18-1057 | Same as item 18-1050 to 18-1056, but fixing only. | Each | 52 |
| 18-1058 | Add to item 18-1050 to 18-1056 or 18-1057, if removal only. | Each | 39 |
| 18-1059 | Steel Sch 40 Gate, valve flanged and drilled to B.S Table 18-1-10, Rising Steam, complete with packing sheet 40mm dia, supply and fixing. | Each | 10467 |
| 18-1060 | Same as item 18-1059 but 50mm dia. | Each | 12467 |
| 18-1061 | Same as item 18-1059 but 80mm dia. | Each | 18611 |
| 18-1062 | Same as item 18-1059 but 100mm dia. | Each | 24113 |
| 18-1063 | Same as item 18-1059 but 150mm dia. | Each | 41113 |
| 18-1064 | Same as item 18-1059 to 18-1063 but fixing only. | Each | 288 |
| 18-1065 | Add to item 18-1059 to 18-1063 or 18-1064, if removal only. | Each | 144 |

# SECTION-19

# WATER SUPPILY INSTALLATIONS

# RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| 11 | | |
| | | |
| | | |
|

# SECTION -19

# WATER SUPPLY INSTALLATIONS

## SPECIFICATIONS

**19.0.** This section covers all operations for centrifugal, reciprocating, submersible pumps, deep well turbines, tube well boring, development and sterilization. It also include use of casing, blind pipes, strainer, and chlorinators with accessories. Engineer-in-Chiefs Branch, Technical Instructions (Tube Well Installations) Volume-IV (Revised) 2001, shall be followed for guidance.

## MATERIAL REQUIREMENTS

**19.1. Blind/ Casing Pipes.** Shall be of MS pipes as specified, approved by the Engineer-in-Chief Branch.

**19.2. Strainers, Filter or screens.** Shall be of V-WIRE V-WEDGE Stainless steel / Low Carbon Galvanized Iron (LCGI) strainer as approved by the Engineer-in-Charge. Selection of filter may be based on structural strength, open area and well hydraulics.

**19.3. Water Supply Pumping Sets.** Centrifugal pumping sets, Centrifugal deep well turbine and submersible pumps shall be as standardized by the Engineer-in-Chief Branch.

19.3.1 The centrifugal pump motor sets shall be heavy duty industrial type suitable for continuous and quiet operation.

19.3.2 The centrifugal pumps shall be single stage, small sizes of vertically split casing and large sizes of horizontally split casing.

19.3.3 The pumps to be volute type, cast iron body, fully bronze fitted, bronze impeller of radial type, with double curvature vanes, stainless steel shaft or shaft sleeve, properly lubricated bearings, readily accessible stuffing box with packing and seal cage, flanged suction and discharge connections, integral cast iron base plate for the pump and the motor with drain outlet for connection to the nearest drain point, flexible coupling between the motor and the pump shafts covered with approved guard, pump casing to be complete with drain and vent plugs and designed, tested and proven tight for a test pressure at least equal to 1-1/2 times the maximum working pressure.

19.3.4 The pumps shall have gate valves and strainers on the suction side, globe valves on the discharge side and pressure gauges on suction and discharge sides. If pumps are operating in parallel than a check valve to be installed on the discharge side of each pump.

19.3.5 The pumps shall be direct driven by a constant speed motor and provided with a suitable starter.

19.3.6 Each pump shall be guaranteed for circulating the specified water quantity against specified net discharge head under the specified conditions of operation when operating continuously without overheating the motor, bearings etc.

19.3.7 The pump shall be selected for quiet operation so that pump noise is not audible outside the plant room. The pump sound shall not be transmitted to the building structure.

19.3.8 An anti-vibration foundation material for isolating the pump foundations from the building structure will be provided.

19.3.9 The number, size and conditions of operation for pumps required for different systems are specified in the schedule of equipment and the pumps location shown in the drawings.

19.3.10. All electric motors shall be of minimum IE-2 from 0.75 KW upto 355 KW insulation class F, enclosure characteristics IP-55.

**19.4. Chlorinators**

19.4.1. **Standard Chlorinators**

19.4.1.1. Chlorinators shall be direct cylinder mounted with ejector, safety / check valves and other standard accessories / spare parts as per manufacturer's specification and as standardized by Engineer-in-Chief Branch.

19.4.1.2. All the standard accessories of the unit will be supplied as a part of equipment for installation and operation according to manufacturer's manual / specifications and to meet the site requirements.

19.4.1.3. The spares will be supplied according to the manufacturer's recommendations, if any. The rates of spares as well as accessories required for installation purpose will be considered free of cost to be supplied by the manufacturer.

19.4.2. **Hypo Chlorinator.** It is more efficient equipment with improved processes which is now in use. Limited brands of Hypo chlorinators are in the market. Hypo chlorinator Solenoid Type, has been considered for this

Schedule. It operates on 220 / 240V, 50 cycles and is fitted with a diaphragm type of non-corrosive material with standard suction and discharge tubing and injectors. The work shall also include the electric wiring with main control and fluid control valve on the feeding / suction line. Initially, 60Kg of Sodium Hypochlorite (NaOCI) and spare parts for maintenance period will be supplied as per the manufacturer's recommendations.

**19.5. Chlorine Gas Cylinders.** Chlorine gas cylinder, bottle type, Manganese steel body, neck ring and valve cap fitted with chlorine gas valve, having fusible plug made according to the International / Pakistan Standard Specifications arrdl s ,approved by the Engineer-in-Chief, with first filling of liquid Chlorine after hydraulic testing and obtaining NOC from 'the Department of Explosives.

## CONSTRUCTION REQUIREMENTS

**19.6. Tube Well** boring is a highly specialized job. ft must therefore be given to experts, equipped with specific technical skill and suitable equipment. Any of the following methods can be adopted for well-boring with the permission of the Engineer-in-Charge:-

(1) **Hydraulic Drilling** may be under taken by employing the Straight/ Reverse Rotary methods.

(a) **Straight Rotary Drilling** shall be carried out in consolidated rocky fonnations, consisting fractured rocks, lime stone or hard clay and shale using special Bentonite Higel optimum mud solution and cognis powder mud / foam.

(b) **Reverse Rotary Drilling** shall be carried out in unconsolidated rock where formations mainly consist of sand & clay, using drilling mud/ foam.

(2) **Percussion Drilling (in rare cases).** This type of drilling is limited upto certain depth in boulder formation.

**19.7.** Corresponding dia of blind pipes for different dia of bore holes shall be as given in Table 19-1.

**TABLE 19-1**
**DIA OF BLIND PIPES**
CORRESPONDING TO DIFFERENT DIA OF BORE HOLES

| Dia of borehole (mm) | Dia of blind pipe (mm) |
|---|---|
| 375 | 200 |
| 450 | 250 |
| 600 | 300 |

**19.8.** Thickness of gravel pack and sanitary seal may vary from 80-125 mm. Two gravel feed pipes shall be placed diagonally opposite outside the housing pipe and should protrude Sanitary seal by 1.524 M.

**19.9.** Yield of a **Trial bore** hole, in limited ground water areas is estimated using electrical logging, compressed air or suitable pumping system. Enlarging of trial bore may be allowed after satisfactory results.

**19.10. Well Development.** Method of Well Development should correspond to characteristics of water bearing strata and well hydraulics.

**19.11. Well Sterilization.** Sterilization of the bore is very important. It is recommended to use 50 Kg Bleaching powder from fresh stock. A solution is made in water and after 24 hours; the same is poured into the well up to gravel pack. After 2 hours, approximately 500 gallon of fresh water shall be added. The entire bore is pumped out to waste after another 2 hours.

**19.12 Water purification System.** Water purification plant system plant capacity **1000/500 GPH** shall be of following details:-

(1) **Multimedia Filter.** Multi Media filter filled with graded washed silica quarts 0.45 mm grade in closed fiber reinforced glass vessel equipped with multiport valve, automatic air bleed valve,

(2) **Granular Activated Carbon Filter (GAC).** GAC filter filled with proper and approved best quality media in closed FRP vessel equipped with automatic bleed air value, multiport valve.

(3) **Back Wash Pump.** Suitable back wash eclectic motor driven pump manually and automatic operation.

(4) **Fine Sediment Filter.** 2 x Fine sediment filter with 1 and 5 micron cartridge housed in polypropylene housing.

(5) **Ultraviolet + Sterilizer.** 1 x ultraviolet sterilizer stainless steel housing equipped with 2 x hardened glass, slim line imported lamps ultraviolet dosage not less than 50,000 MW/Sec/CM2 for 1000 GPH and 30,000 MW/Sec/CM2 for 500 GPH

(6) **Stainless Steel Header.** Stainless steel header with 6 outlet taps complete in all respect.

## METHOD OF MEASUREMENTS

### 19.13 Tube Well Measurement

19.13.1. Per linear metre length of work done in drilling, lowering pump housing casing, tube well casing and slotted casing, shrouding and provision of sanitary seal.

19.13.2. Unit rate per tube well for developing, testing and sterilization, installation of pump, and completing other "one job works" at each well site.

## CLARIFICATION OF RATES

**19.14.** The rates inter alia, including particularly:-

(1) The capacity and head of pumping sets shall be in accordance with the design requirements and paid under the Schedule item having the same range i.e. for 0.021 cum (0.75 cusec) shall be paid under Schedule item, having range above 0.014 - 0.028 cum (0.5 - 1 cusec) without extra cost.

(2) The pump setting shall also be in accordance with design requirement and be adjusted, if varies from relevant Schedule item.

(3) The rates of centrifugal / reciprocating pumps, including the supply and installation of pump and motor mounted on common bed plate, (except PCC foundation).

(4) The rate of turbine / submersible pumping set, including the supply and installation of pump and motor with shafts (less shafts with submersible) and column pipes.

(5) The cost of motor starter/ motor control unit included in the rate of turbine/ submersible pumps and centrifugal pumps. The cost of wiring from starter to motor (less submersible pump) will be paid separately.

(6) Only unsuccessful trial bore will be paid; i.e., trial bore converted into main bore will not be paid as the payment will be made as part of main bore.

**ITEM RATES**

| Sl No | Description | Unit | Rate (Rs)I |
|---|---|---|---|
| | **Centrifugal Pumping Set** | | |
| 19-1 | Centrifugal Pumping set, AC, electric motor driven, 400 volts, 3 phase, 50 cycles, 1 HP, mounted on a common channel base, total head **20/25 Motor, efficiency IE-2, Insulation class** 'F', **enclosure characteristics IP-55,** supply and fixing. | Each | 40189 |
| 19-2 | Same as item 19-1, but 2 HP motor, for **25/30 M** head. | Each | 41630 |
| 19-3 | Centrifugal Pumping set, AC, electric motor driven, 220 /230 V, SP, 1 HP, 50 cycles, mounted on a common channel base, total head **20/25 Motor efficiency IE-2, insulation class** 'F', **enclosure characteristics IP-55,** supply and fixing. | Each | 36541 |
| 19-4 | Same as item 19-3, but with 1/2 HP motor for **10/15 M** head. | Each | 31790 |
| 19-5 | Same as item 19-1, but fixing only. | Each | 518 |
| 19-6 | Same as item 19-2, but fixing only. | Each | 638 |
| 19-7 | Same as item 19-3, but fixing only. | Each | 518 |
| 19-8 | Same as item 19-4, but fixing only. | Each | 518 |
| 19-9 | Add to item 19-1 or 19-5, if removal only. | Each | 388 |
| 19-10 | Add to item 19-2 or 19-6, if removal only. | Each | **478** |
| 19-11 | Add to item 19-3 or 19-7, if removal only. | Each | 388 |
| 19-12 | Add to item 19-4 or 19-8, if removal only. | Each | 388 |
| 19-13 | Centrifugal Pumping set with A.C electric motor, 400V, 3 phase, 5 HP, 50 cycles, motor and pump directly coupled and mounted on common bed plate/ channel base, duly aligned, head 10-13 M, Capacity 100 - 200 GPM, 1450 RPM, Complete, with anchoring bolts/nuts, **Motor efficiency IE-2, Insulation class 'F', enclosure characteristics IP-55,** supply and fixing. | Each | 405423 |
| 19-14 | Same as item 19-13, but capacity above 200 upto 300 GPM, head **11-15 M** 10 HP. | Each | 487923 |
| 19-15 | Same as item 19-13, but capacity above 300 upto 550 GPM, head **12-17 M,** 15 HP. | Each | 574901 |
| 19-16 | Same as item 19-13, but capacity 100 to 210 GPM, head **27-33M,** 2850/2900 RPM, 15 HP. | Each | 461232 |
| 19-17 | Same as item 19-16, but capacity 150 to 250 GPM, head **38 .. 41 M,** 15 HP. | Each | 465177 |
| 19-18 | Same as item 19-16, but capacity 300 GPM, head **35 M,** 15 HP. | Each | 477363 |
| 19-19 | Same as item 19-13, but fixing only. | Each | 1380 |
| 19-20 | Same as item 19-14, but fixing only. | Each | 1380 |
| 19-21 | Same as item 19-15, but fixing only. | Each | 1898 |
| 19-22 | Same as item 19-16, but fixing only. | Each | 1553 |
| 19-23 | Same as item 19-17, but fixing only. | Each | 1898 |
| 19-24 | Same as item 19-18, but fixing only. | Each | 2243 |
| 19-25 | Add to item 19-13 or 19-19, if removal only. | Each | 1035 |
| 19-26 | Add to item 19-14 or 19-20, if removal only. | Each | 1035 |
| 19-27 | Add to item 19-15 or 19-21, if removal only. | Each | 1423 |
| 19-28 | Add to item 19-16 or 19-22, *if* removal only. | Each | 1164 |
| 19-29 | Add to item 19-17 or 19-23, *if* removal only. | Each | 1423 |
| 19-30 | Add to item 19-18 or 19-24, if removal only. | Each | 1682 |
| | **Tube Well Boring** | | |
| 19-31 | In any soil, drilling bore hole, 375 mm dia, employing **Reverse Rotary, Hydraulic Percussion method,** bore upto 50 M depth, complete. | Metre | 4330 |

| Sl No | Description | Unit | Rate (Rs)I |
|---|---|---|---|
| 19-32 | Same as item 19-31, but450 mm dia bore hole. | Metre | 4920 |
| 19-33 | Same as item 19-31, but 600 mm dia bore hole. | Metre | 5820 |
| 19-34 | In any soil, drilling bore hole, 375 mm dia, employing **Reverse Rotary, Hydraulic** / **Percussion method,** bore more than SOM but upto 100 M depth, complete. | Metre | 5117 |
| 19-35 | Same as item 19-34, but 450 mm dia bore hole. | Metre | 5700 |
| 19-36 | Same as item 19-34, but 600 mm dia bore hole. | Metre | 6593 |
| 19-37 | In any soil, drilling a bore hole 375 mm dia, employing **Reverse Rotary, Hydraulic** / **Percussion method,** bore more than 100 M but upto 150M depth complete. | Metre | 5820 |
| 19-38 | Same as item 19-37, but 450 mm dia bore hole. | Metre | 6396 |
| 19-39 | Same as item 19-37, but 600 mm dia bore hole. | Metre | 7080 |
| 19-40 | In any soil, drilling bore hole 375 mm dia, employing **Reverse Rotary/ Hydraulic/ Percussion method,** bore beyond 150 M depth, complete. | Metre | 6494 |
| 19-41 | Same as item 19-40, but 450 mm dia bore hole. | Metre | 6684 |
| 19-42 | Same as item 19-40, but 600 mm dia bore hole. | Metre | 7860 |
| 19-43 | In any soil, drilling **Trial bore** hole 150 mm dia, bore up to 50 M depth. | Metre | 3780 |
| 19-44 | Same as item 19-43, but bore above 50 M and upto 100 M depth | Metre | 4200 |
| 19-45 | Same as item 19-43, but bore above 100 M and upto 150 M depth | Metre | 4740 |
| 19-46 | Same as item 19-43, but bore beyond 150 M depth. | Metre | 5040 |
| 19-47 | Supply and installation, **MS Blind pipe** 5 mm thick, 200mm dia with welding joints, complete. | Metre | 7042 |
| 19-48 | Same as item 19-47, but 250 mm dia and 5.5 mm thick. | Metre | 9590 |
| 19-49 | Same as item 19-47, but 300 mm dia and 6.35 mm thick. | Metre | 12965 |
| 19-50 | Supply and Lowering in Predrilled bore hole 200 mm dia V-WIRE V-WEDGE continuous slot, **stainless steel,** water well screen proper welded with MS pipe complete in all respect. | Metre | 30605 |
| 19-51 | Same as item 19-50, but 250 mm dia. | Metre | 41047 |
| 19-52 | Same as item 19-50, but 300 mm dia. | Metre | 56443 |
| 19-53 | Supply and Lowering in Predrilled bore hole 200mm dia V-WIRE V-WEDGE continuous slot, **Low Carbon Galvanized Iron (LCGI),** water well screen proper welded with MS pipe complete in all respect. | Metre | 26058 |
| 19-54 | Same as item 19-53, but 250 mm dia. | Metre | 30915 |
| 19-55 | Same as item 19-53, but 300 mm dia. | Metre | 35710 |
| 19-56 | Supply and installation of **Bail Plug,** 200 mm dia of approved specifications. | Each | 9872 |
| 19-57 | Same as item 19-56, but 250 mm dia. | Each | 12685 |
| 19-58 | Same as item 19-56, but 300 mm dia. | Each | 15537 |
| 19-59 | Supply and **Pouring of Shrouding Gravel** of requisite grade, in annular space between blind pipe/strainer and bore hole according to specifications for 200 mm dia blind pipe/strainer. | Metre | 199 |
| 19-60 | Same as item 19-59, but for 250 mm dia blind pipe/strainer. | Metre | 270 |
| 19-61 | Same as item 19-59, but for 300 mm dia blind pipe/strainer. | Metre | 476 |
| 19-62 | Provision of **Sanitary Seal** of approved design and specification for 200 mm dia blind pipe. | Metre | 1028 |
| 19-63 | Same as item 19-62, but for 250 mm dia blind pipe. | Metre | 1398 |
| 19-64 | Same as item 19-62, but for 300 mm dia blind pipe. | Metre | 2610 |

| Sl No / | Description | Unit | Rate (Rs)l |
|---|---|---|---|
| 19-65 | **Develop, Test and Sterilize** tube well in accordance with approved procedure; 200 mm dia | Each | 132000 |
| 19-66 | Same as item 19-65, but 250 mm dia. | Each | 168000 |
| 19-67 | Same as item 19-65, but 300 mm dia. | Each | 168000 |
| | **Deep Well -Turbine/ Pump** | | |
| " 19-68 | Pumping set **Deep Well Turbine,** hollow shaft, AC electric motor driven, 400 volts 3 phase, 50 cycles, complete with shafts, column pipes, motor and auto star delta starter, pump capacity **0.50-0.70 cusec,** upto 46 M head, pump setting upto 18 M with electric motor, 15 HP, **motor efficiency IE2, insulation class 'F', enclosure characteristics IP-55,** supply and fixing. | Each | 1264665 |
| 19-69 | Same as item 19-68, but pump capacity **above 0.7 and upto 1.0 cusec at 46 M** head, pump setting upto 18 M, with 20 HP motor. | Each | 1359195 |
| 19-70 | Same as item 19-68, but pump capacity **1.0-1.25 cusec at 35-47 M** head, pump setting upto 18 M with 30 HP motor. | Each | 1504875 |
| 19-71 | Same as item 19-68, but pump capacity above **1.0 cusec upto 1.5 cusec at 46 M** head, pump setting upto 18 M with 30 HP motor. | Each | 1505328 |
| 19-72 | Same as item 19-68, but pump capacity above 0.5 cusec upto **0.75 cusec at 47-61 M head, pump setting upto 46 M,** with motor 30 HP. | Each | 1608798 |
| 19-73 | Same as item 19- 68, but pump capacity upto **0.5-0.8 cusec at 60-78 M head, pump setting upto 46 M** with 30 HP motor. | Each | 1800765 |
| 19-74 | Same as item 19-68, but pump capacity **above 1.0 and upto 1.5 cusec, 63-92 M head, pump setting upto 46 M** with motor 60 HP. | Each | 2783686 |
| 19-75 | Same as item 19-68, but pump capacity **above 1.5 and upto 2.0 cusec, 40-62 M head, pump setting upto 46 M,** with motor 50 HP | Each | 2667588 |
| 19-76 | Same as item 19-68, but pump capacity **above 1.0 and upto 1.5 cusec, 47-70 M** head, pump setting upto 46 M with motor 40 HP. | Each | 2541648 |
| 19-77 | Same as item 19-68, but pump capacity **above 0.80 and upto 1.0 cusec, 68-85 M** head, pump setting upto 46 M with motor 30 HP. | Each | 2289918 |
| 19-78 | Same as item 19-68, but pump capacity **above 2.0 and upto 2.25 cusec, 40-50 M** head, pump setting upto 46 M with motor 60 HP. | Each | 2676628 |
| 19-79 | Same as item 19-68, but pump capacity **above 2.0 and upto 2.25 cusec, 58-78 M** head, pump setting up to 46 M with motor 100 HP. | Each | 3019008 |
| 19-80 | Same as item 19-68, but pump capacity **above 0.75 and upto 1.0 cusec, 66-88 M** head, pump setting upto 46 M with motor 40 HP. | Each | 2315565 |
| 19-81 | Same as item 19-68, but fixing only. | Each | 3945 |
| 19-82 | Same as item 19-69, but fixing only. | Each | 4875 |
| 19-83 | Same as item 19-70, but fixing only. | Each | 4875 |
| 19-84 | Same as item 19-71, but fixing only. | Each | 5805 |
| 19-85 | Same as item 19-72, but fixing only. | Each | 5805 |
| 19-86 | Same as item 19-73, but fixing only. | Each | 5805 |
| 19-87 | Same as item 19-74, but fixing only. | Each | 5805 |
| 19-88 | Same as item 19-75, but fixing only. | Each | 7665 |
| 19-89 | Same as item 18-76, but fixing only. | Each | 5805 |
| 19-90 | Same as item 19-77, but fixing only. | Each | 4875 |
| 19-91 | Same as item 19-78, but fixing only. | Each | 7665 |
| 19-92 | Same as item 19-79, but fixing only. | Each | 5805 |
| 19-93 | Same as item 19-80, but fixing only. | Each | 5805 |
| 19-94 | Add to item 19-68 or 19-81, if removal only. | Each | 2959 |

| SI No | j Description | Unit | Rate (Rs)I |
|---|---|---|---|
| 19-95 | Add to item 19-69 or 19-82, if removal only. | Each | 3656 |
| 19-96 | Add to item 19-70 or 19-83, if removal only. | Each | 3656 |
| 19-97 | Add to item 19-71 or 19-84, if removal only. | Each | 4354 |
| 19-98 | Add to item 19-72 or 19-85, if removal only. | Each | 3656 |
| 19-99 | Add to item 19-73 or 19-86, if removal only. | Each | 4354 |
| 19-100 | Add to item 19-74 or 19-87, if removal only. | Each | 4354 |
| 19-101 | Add to item 19-75 or 19-88, if removal only. | Each | 5749 |
| 19-102 | Add to item 19-76 or 19-89, if removal only. | Each | 4354 |
| 19-103 | Add to item 19-77 or 19-90, if removal only. | Each | 3656 |
| 19-104 | Add to item 19-78 or 19-91, if removal only. | Each | 5749 |
| 19-105 | Add.to item 19-79 or 19-92, if removal only. | Each | 4354 |
| 19-106 | Add to item 19-80 or 19-93, if removal only. | Each | 4354 |
| | **Extra Column Pipe** | | |
| 19-107 | Extra column pipe, with motor shaft (3 M length each), complete with bearing sockets, threaded coupling shaft, sleeve and rubber bearing, complete set (125 mm x 3 m x 25 mm), supply and fixing. | Each | 57210 |
| 19-108 | Same as item 19-107, but size (150 mm x 3 m x 30 mm). | Each | 78690 |
| 19-109 | Same as item 19-107, but size (150 mm x 3 m x 35 mm). | Each | 78690 |
| 19-110 | Same as item 19-107, but size (175 mm x 3 m x 35 mm). | Each | 110805 |
| 19-111 | Same as item 19-107, but size (175 mm x 3 m x 45 mm). | Each | 142065 |
| 19-112 | Same as item 19-107, but fixing only. | Each | 930 |
| 19-113 | Same as item 19-108, but fixing only. | Each | 930 |
| 19-114 | Same as item 19-109, but fixing only. | Each | 930 |
| 19-115 | Same as item 19-110, but fixing only. | Each | 1395 |
| 19-116 | Same as item 19-111, but fixing only. | Each | 1395 |
| 19-117 | Add to item 19-107 or 19-112, if removal only. | Each | 698 |
| 19-118 | Add to item 19-108 or 19-113, if removal only. | Each | 698 |
| 19-119 | Add to item 19-109 or 19-114, if removal only. | Each | 698 |
| 19-120 | Add to item 19-11O or 19-115, if removal only. | Each | 1046 |
| 19-121 | Add to item 19-111 or 19-116, if removal only. | Each | 1046 |
| | **Submersible Pump** | | |
| 19-122 | Pumping set submersible, with AC electric motor driven, 400 V, 3 phase, 50 cycles, complete with pump, motor, cable, column pipes, motor control unit, pump capacity **0.5 cusec upto 97 M** head, pump setting 60 M with 25 HP motor, 2900 RPM, **motor efficiency IE2, insulation class 'F', enclosure characteristics IP-68,** supply and fixing. | Each | 1533075 |
| 19-123 | Same as item 19-122, but pump capacity **0.5 cusec at 97-106 M** head, pump setting 60 M, with 30 HP motor, 2900 RPM. | Each | 1482675 |
| 19-124 | Same as item 19-122, but pump capacity **1.0 cusec at 88-97 M** head, pump setting 50 M, with 50 HP motor, 2900 RPM. | Each | 2118476 |
| 19-125 | Same as item 19-122, but pump capacity **1.0 cusec at 97-105 M** head, pump setting 60 M with 60 HP motor, 2900 RPM. | Each | 2668556 |
| 19-126 | Same as item 19-122, but pump capacity **1.0 to 1.25 cusec, 96-110 M** head, pump setting 60 M, with 60 HP motor, 2900 RPM. | Each | 2668556 |
| 19-127 | Same as item 19-122, but pump capacity **1.50 cusec and upto 88 M** head, pump setting 60 M with 75 HP motor, 2900 RPM. | Each | 3017988 |
| 19-128 | Same as item 19-122, but pump capacity 1.25-1.50 cusec at 95-105 M head, pump setting 60 M with 75 HP motor 2900 RPM. | Each | 3017988 |

| Sl No | Description | Unit | Rate (Rs)l |
|---|---|---|---|
| 19-129 | Same as item 19-122, but pump capacity 1.50 to 1.75 cusec at 88-102 M head, pump setting 60 M with 75 HP motor, 2900 RPM. | Each | 3018453 |
| 19-130 | Same as item 19-122, but pump capacity **1.75 cusec at 82-91 M** head, pump setting 60 M with 85 HP motor 2900 RPM. | Each | 3018453 |
| 19:-131 | Same as item 19-122, but fixing only. | Each | 3015 |
| **19-132** | Same as item 19-123, but fixing only. | Each | 3015 |
| **19-133** | Same as item 19-124, but fixing only. | Each | **3248** |
| 19-134 | Same as item 19-125, but fixing only. | Each | **3248** |
| 19-135 | Same as item 19-126, but fixing only. | Each | **3248** |
| 19-136 | Same as item 19-127, but fixing only. | Each | **3480** |
| 19-137 | Same as item 19-128, but fixing only. | Each | **3480** |
| 19-138 | Same as item 19-129, but fixing only. | Each | 3945 |
| 19-139 | Same as item 19-130, but fixing only. | Each | 3945 |
| 19-140 | Add to item 19-122 or 19-131, if removal only. | Each | 2261 |
| 19-141 | Add to item 19-123 or 19-132, if removal only. | Each | 2261 |
| **19-142** | Add to item 19-124 or 19-133, if removal only | Each | **2436** |
| **19-143** | Add to item 19-125 or 19 134, if removal only | Each | **2436** |
| **19-144** | Add to item 19-126 or 19-135, if removal only | Each | **2436** |
| 19-145 | Add to item 19-127 or 19-136, if removal only | Each | 2610 |
| 19-146 | Add to item 19-128 or 19-137, if removal only | Each | 2610 |
| 19-147 | Add to item 19-129 or 19-138, if removal only | Each | 2959 |
| 19-148 | Add to item 19-130 or 19-139, if removal only | Each | 2959 |
| | **Chlorinators** | | |
| 19-149 | Gas Chlorinator "Imported" direct cylinder mounted, all vacuum operated, max capacity 25-50 pounds per qay (ppd}, feed gas chlorination ratio 20:1, with all operational standard accessories, make Pennsylvania USA , Model 201-CI, supply and fixing. | Each | 266499 |
| 19-150 | Same as item 19-149, but **Model 481-CI** | Each | 169576 |
| 19-151 | Same as item 19-149, but fixing only. | Each | 345 |
| 19-152 | Same as item 19-150, but fixing only. | Each | 345 |
| 19-153 | Add to item 19-149 or 19-151, if removal only. | Each | 259 |
| 19-154 | Add to item 19-150 or 19-152, if removal only. | Each | 259 |
| 19-155 | **Multistage Centrifugal mono-block chlorinator,** booster pumping set, size 40 mm x 32 mm dia suction /delivery having gunmetal impellers, stainless steel shaft, stuffing box, fitted to 3 HP 380/400 V, 50 cycles, 3 phase, AC electric motor on common shaft, capacity **15 gpm at 41 M** total discharge head, **motor efficiency IE2, insulation class 'F', enclosure characteristics IP-55** supply and fixing. | Each | 67035 |
| 19-156 | Same as item 19-155, but motor capacity 5 HP. | Each | 85035 |
| 19-157 | Same as item 19-155, but fixing only. | Each | 1035 |
| 19-158 | Same as item 19-156, but fixing only. | Each | 1035 |
| 19-159 | Add to item 19-155, 19-156, 19-157 or 19-158, if removal only. | Each | 776 |
| 19-160 | Gas Chlorinator cylinder mounted all vacuum operated, feed ratio 20:1, capacity and measuring upto 100 ppd, consisting of vacuum regulator with chlorine gas flow meter, gate valve, chlorine supply indicator and vent, manually adjustable flow rate, vent and vacuum tubing, vacuum ejector with diffuser and water back-flow, check valve, complete all as specified, supply and fixing. | Each | 77268 |

| Sl No | Description | Unit | Rate (Rs)l |
|---|---|---|---|
| 19-161 | Hypo-Chlorinator, Solenoid type having Liquid chlorine feeding capacity 20 gpd at 150 psi fitted with flow rate control knob manually adjustable 0-100%, operated at 220 / 240V, 50 Hz, diaphragm type of non-corrosive material with standard suction/discharge tubing, injector, pressure auto relief valve, anti-siphon valve, solution storage tank of 50 gal capacity PE/PVC with stand duly painted as specified, supply and fixing. | Each | 93688 |
| 19-162 | Same as item 19-160, but fixing only. | Each | 345 |
| 19-163 | Same as item 19-161, but fixing only | Each | 1380 |
| 19-164 | Add to item 19-160 or 19-162 if removal only. | Each | 259 |
| 19-165 | Add to item 19-161 or 19-163, if removal only. | Each | 690 |
| | **Chlorine Gas Cylinder** | | |
| 19-166 | Chlorine Gas cylinder, **Imported** Approved Type 68 kg capacity, bottle type, with first filling of liquid chlorine after Hydraulic testing, supply and fixing. | Each | 107749 |
| 19-167 | Same as item 19-166 but fixing only. | Each | 56 |
| 19-168 | Add to item 19-166 or 19-167, if removal only. | Each | 42 |
| | **Reciprocating Pump** | | |
| 19-169 | Reciprocating pump (donkey pump) 1450 RPM, driven with single phase electric motor 1/2 HP, mounted on frame and fixed complete head 15-40 M, discharge **34-29 lit/min,** supply and fixing. | Each | 11123 |
| 19-170 | Same as item 19-169, but heavy duty driven by electric motor 2 HP, SP head 30-70 M, discharge **50-39 lit/min.** | Each | 31823 |
| 19-171 | Same items as 19-169 or 19-170, but fixing only. | Each | 803 |
| 19-172 | Add to item 19-169, 19-170 or 19-171, if removal only. | Each | 602 |
| | **Motor Electric** | | |
| 19-173 | Motor electric, Motor Efficiency, single phase, 220V, 1/2 HP, 1425 /1450 RPM, supply and fixing. | Each | 11153 |
| 19-174 | Motor electric, Motor Efficiency IE-2, Insulation Class F, Enclosure characteristic IP-55, single phase, 220V, 2 HP, 1425 /1450 RPM, supply and fixing. | Each | 16673 |
| 19-175 | Same as item 19-173 or 19-174, but fixing only. | Each | 173 |
| 19-176 | Add to item 19-173, 19-174 or 19-175, if removal only. | Each | 129 |
| | **Sluice Valve** - **Oil Quality** | | |
| 19-177 | Cast Steel Gate/Sluice valve, flanged and drilled to BS, Table 18-1-10, rising stem, oil quality, Class-150 lbs complete with packing sheet, 25 mm dia, supply and fixing. | Each | 14670 |
| 19-178 | Same as item 19-177, but 40 mm dia. | Each | 16707 |
| 19-179 | Same as item 19-177, but 50 mm dia. | Each | 17830 |
| 19-180 | Same as item 19-177, but 62 mm dia. | Each | 23759 |
| 19-181 | Same as item 19-177, but 75/80 mm dia. | Each | 29094 |
| 19-182 | Same as item 19-177, but 100 mm dia. | Each | 35880 |
| 19-183 | Same as item 19-177, but 150 mm dia. | Each | 49352 |
| 19-184 | Same as item 19-177 to 19-179, but fixing only. | Each | 561 |
| 19-185 | Same as item 19-180 to 19-181, but fixing only. | Each | 733 |
| 19-186 | Same as item 19-182 to 19-183, but fixing only. | Each | 1336 |
| 19-187 | Add to item 19-177 to 19-179 or 19-184, if removal only. | Each | 259 |
| 19-188 | Add to items 19-180 to 19-181 or 19-185, if removal only. | Each | 388 |
| 19-189 | Add to items 19-182 to 19-183 or 19-186, if removal only. | Each | 698 |

| Sl No | Description | Unit | Rate (Rs)l |
|---|---|---|---|
| | **Disinfection of Water Pipe Line** | | |
| 19-190 | Disinfection of water pipe line, 25 mm dia with mixture of clear water and liquid Chlorine, as specified in Para 18.2.9. | Metre | 10 |
| 19-191 | Same as item 19-190, but 40 mm dia. | Metre | 10 |
| 19-192 | Same as item 19-190, but 50 mm dia. | Metre | 12 |
| 19-193 | Same as item 19-190, but 65 mm dia. | Metre | 14 |
| 19-194 | Same as item 19-190, but 80 mm dia. | Metre | 16 |
| 19-195 | Same as item 19-190, but 100 mm dia. | Metre | 20 |
| 19-196 | Same as item 19-190, but 150 mm dia. | Metre | 34 |
| 19-197 | Same as item 19-190, but 200 mm dia. | Metre | 53 |
| 19-198 | Same as item 19-190, but 250 mm dia. | Metre | 77 |
| 19-199 | Same as item 19-190, but 300 mm dia. | Metre | 107 |
| | **Mono Block Pumping Set** | | |
| 19-200 | Mono Block Pumping Set (cast iron body) single Phase, electric Motor, with copper winding, 1/2 HP, max suction 6 M, head 8-20 Metre, discharge 20-55 LiVMin, supply and fixing. | Each | 11603 |
| 19-201 | Mono Block Pumping Set (cast iron body) single Phase, electric Motor Efficiency IE-2, Insulation Class F, Enclosure characteristic IP-55, with copper winding, 1 HP, max suction 6 M, Head 10-24 Metre and discharge 25-70 Ur/Min supply and fixing. | Each | 15545 |
| 19-202 | Same as item 19-200, 19-201 but fixing only. | Each | 803 |
| 19-203 | Add to Item 19-200, 19-201 or 19-202, if removal only. | Each | 602 |
| | **Water purification System** | | |
| 19-204 | Supply, Fixing testing and commission of water purification plant system plant capacity **1000 GPH** with multimedia filter, Granular activated carbon filter, Back wash pump, Fine sediment filter Ultraviolet+sterilizer and stainless steel header all as specified. | Each | 698430 |
| 19-205 | Same as Item 19-204 but **500 GPH.** | Each | 558510 |
| 19-206 | Same as Item 19-204 but fixing only. | Each | 9810 |
| 19-207 | Same as Item 19-205 but fixing only. | Each | 4965 |
| 19-208 | Add to item 19-204 to 19-207 if removal only. | Each | 4905 |
| 19-209 | Pressure switch complete with all accessories for pumping set up to 1 HP, supply and fixing. | Each | 12585 |
| 19-210 | Same as Item 19-209 but fixing only. | Each | 375 |
| 19-211 | Add to item 19-209 to 19-210 if removal only. | Each | 188 |

SECTION - **20**

# INTERNAL SEWERAGE

# RECORD OF AMENDMENTS

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| 1 | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-20
# INTERNAL SEWERAGE

## SPECIFICATIONS

**20.0.** This section consists of all operations for internal sewerage involving Soil, Waste, and Ventilation Cl Spun and uPVC (non pressure type, like Nikasi) pipes etc.

## MATERIAL REQUIREMENTS

**20.1. Cl- (Soil, Waste and Ventilation) Pipes.** Pipes to be spun (Centrifugally casted) conforming to BS No.416

20.1.1. Weights of Cl Spun Pipes and fittings are given in Table 20-1 and 20-2:-

**TABLE 20-1**

**Cl Pipes (Spun)**

| Dia Nominal mm | Wall Thickness mm | Weight in Kg | Pipe's Length (M) |
|---|---|---|---|
| 50mm | 5mm | 10.5 Ka | 1.83 |
| 75mm | 5mm | 15 Ka | 1.83 |
| 100mm | 5mm | 20 Ka | 1.83 |
| 150mm | 5mm | 34 Ka | 1.83 |

Note:- Tolerance in weight± 5%.

**TABLE 20-2**
**Cl Fittings (Spun)**

| S.No | Description of Fittings | Weight (Kg) | | | |
|---|---|---|---|---|---|
| | | 50 mm Dia | 75 mm Dia | 100 mm Dia | 150 mm Dia |
| (1) | Plain Bend 90° | 2.3 | 4.0 | 6.75 | 14.8 |
| (2) | Plug Bend 90° | 2.7 | 4.8 | 7.80 | 16.5 |
| (3) | Plain Tee 90° | 3.2 | 5.7 | 9.40 | 18.5 |
| (4) | _Plug Tee 90° | 3.7 | 6.6 | 10.80 | 22.0 |
| (5) | Off-set Bend | 2.5 | 6.0 | 8.00 | - |
| (6) | Plain Y-T Single 90° | 4.8 | 7.0 | 10.30 | 28.5 |
| (7) | Plug Y-T Single 90° | 5.8 | 7.5 | 11.50 | - |
| (8) | Double Branch (Y-T Double) | - | 11.5 | 16.00 | 33.0 |
| (9) | Collar (Single Socket) | 1.5 | 2.2 | 2.80 | 8.0 |
| (10) | Collar (Double Socket) | 2.5 | 2.9 | 4.70 | 9.0 |
| (11) | Plain Cross Tee | 5.0 | 7.5 | 10.00 | 20 |
| (12) | Cowel (Over Vent Pipe) | 1.0 | 1.5 | 2.00 | 4.0 |
| (13) | Gully Trap (6" x 6" x 4") | - | - | 9.00 | - |
| (14) | Gully Trap (9" x 9" x 4") | - | - | 20.00 | - |
| (15) | P-Trap | **4.1** | 5.9 | 8.60 | - |

**Note:** - Tolerance in weight ± 5%

### 20.2. Inlet Ventilators

20.2.1. Inlet ventilators for drain ventilation will be valve inlet type of galvanized iron (GI) with mica valve, to be fixed to vertical or horizontal pipes with run lead or lead wool joints.

20.2.2. In minor repairs, if a length of piping to be renewed is necessarily cut to lengths other than standard lengths, an allowance will be made for each cut. In such case, if piping is supplied by the Contractor, 600mm run "supplied and fixed" will be added to the net measured length to allow for cutting and waste.

**20.3. uPVC Pipes (Non Pressure Types Like Nikasi etc).** uPVC Soil, Waste and Ventilation (SWV) system is made of un-plasticized polyvinyl chloride compound (uPVC). These pipes and fittings conform to ISO 3633 and EN 1329 and available in 50, 75, 110 and 160 mm outside diameter in standard length of 3 and 4M. The dimensions and thickness of the pipes are given in Table 20 - 3.

**TABLE 20 • 3**

**uPVC Pipe Dimensions**

| Nominal Size mm | Nominal Outside Dia (dn) Mm | Wall Thickness (mm) | |
|---|---|---|---|
| | | Minimum | Maximum |
| 50 | 50 | 3.0 | 3.5 |
| 75 | 75 | 3.0 | 3.5 |
| 110 | 110 | 3.2 | 3.8 |
| 160 | 160 | 3.2 | 3.8 |

## CONSTRUCTION REQUIREMENTS

### 20.4. Provision and laying CI - SWV Pipes

20.4.1. Pipes without ears will be secured with holder-bats let into walls and pinned and those with ears will be secured to walls with strong galvanised wrought iron pipe nails, passing 75mm into wall through distance place, all as described below:

20.4.2. Pipes to be socket jointed, with or without ears for fixing as ordered and coated, inside and outside.

20.4.3. Pipes to be blocked-out from walls at least 25mm and securely fixed by means of clamps or by stan_dard pattern malleable CI Lewis ended holder-bats let into walls, the two portions of the holder-bats to be secured with gunmetal bolts and nuts, pipe needs to be of stout WI and after allowing for thickness, of distance pieces to run not less than 75mm into the wall.

20.4.4. All pipes and connections to be jointed with molten lead well caulked. Joints in inverted and difficult positions, however, may be made with lead wool, well caulked. Access doors to be jointed with oil dressed leather and secured with gunmetal set screws

**20.5. UPVC Pipes.** uPVC, when used with a solvent cement jointing system, is comparable in bulk to galvanized steel or iron, but much lighter. It does not suffer the same corrosion problems internally or externally as does CI Pipe. However, it is susceptible to physical damage if exposed above ground and it becomes brittle when exposed to ultraviolet light. The pipe is light to handle and is used extensively around the world for drainage *I* sanitation (waste or soil and storm).

20.5.1. **Transportation and Handling.** The Contractor shall transport, handle and store pipes, joints and fittings in accordance with the manufacturer's recommendations and in a manner which will not result in their damage, deformation or contamination. Protect pipes, joints and fittings from damage; handle pipes and fittings manually or by using lifting appliances or chains, wire rope or canvas slings of a type recommended by the manufacturer and agreed by the Engineer-in-charge and do not use hooks. Do not subject pipes and fittings to rough handling, shock loading, or dropping and do not roll down ramps unless otherwise approved, in which case the ramps must be padded.

20.5.2 **Storage**

20.5.2.1 **Storage of uPVC Pipes, Joints and Fittings.** Rubber jointing rings shall be stored in protective bags. Plastic pipes and fittings shall not be exposed to sunlight or to conditions which may affect the material.

20.5.2.2 **Storage of Elastomeric Joint Rings.** Elastomeric joint rings shall be packed in bags. Lubricant for joints shall be stored in sealed containers and marked to identify the contents. The joint rings and lubricant shall not be exposed to conditions which may affect the materials.

20.5.2.3 **S_torage of Anti-corrosion Tape and Joint Filler.** Anti-corrosion tape and joint filler shall be stored in accordance with the manufacturer's recommendations and in a dry, weatherproof store with a raised floor.

20.5.2.4 **Storage of Granular Bedding Materials.** Aggregates for granular bedding shall not be handled in a manner which will result in mixing of different types and sizes, or in contamination of the aggregates. Different types and sizes of aggregates shall be stored in separate stockpiles

20.5.2.5 **Storage Chambers and Gullies.** Chambers and gullies shall only be lifted at the lifting points recommended by the manufacturers. The units shall not subject to rough handling, shock loading or dropping. The units shall be stored off the ground on level supports which will not result in their damage, deformation or contamination. Protection shall be provided to avoid damage of the units. Manhole covers, gully gratings and valves, including fittings shall be stored off the ground on level supports which will not result in their damage, deformation or contamination. Protection shall be provided to avoid damage of the units of covers and gratings etc.

20.5.3 **Provision and Laying of Pipes.** Each pipe shall be carefully examined on arrival, any defective pipes shall not be used and shall be segregated and marked in a conspicuous manner. Drain shall be laid in straight

lines and to even gradients between the levels shown, with pipes and fittings, of the type and diameter as shown on the drawings. Great care shall be exercised in setting out and determining the levels of the pipes and the Contractor shall provide suitable instruments, set up / maintain all sight rails, bending rods and bench marks etc. necessary for the purpose. Easily accessible clean outs, flush with the floor finish should be provided as shown on drawings. The clean outs of minimum size 3" dia to be connected with main piping at a 45° bend or "Y" of full size. Covers of clean outs should be made of standard pipe size. The cap or plug of clean outs should be threaded and provided with a raised nut or recessed socket for cleaning. All vertical pipes shall be supported by heavy clamps resting on building structure. During installation adequate temporary supports shall be provided so that the piping is not supported by the equipment. Special fittings required in the installation not generally casted by manufacturers shall be got specially casted by Contractor matching with the shell thickness of available specials and no extra payment on this account shall be made to Contractor. Drainage line shall be accurately laid and shall be perfectly true to line and gradient from point to point in both vertical and horizontal planes. Every main shall be straight from manhole to manhole and any change in direction shall take place inside the manhole by the use of the curved main channels, similar changes in internal diameter in drain shall be made in manhole by the use of tappers or bends. Drain pipes shall be installed in the relevant materials as specified elsewhere and shown on the drawings and in accordance with the relevant American Standards specifications. Pipes shall be laid with the sockets leading uphill and shall rest on solid and even foundations for the full length of the barrel. No pipes shall be laid on their collar or on blocks, tiles or other temporary supports. Socket holes shall be formed in the foundation, as short as practicable but sufficiently deep to allow the pipe joinder room to work right round the pipes. Rain water drainage pipes shall be installed for discharging rain water from roof top to ground level as shown on the drawings.

20.5.4 **Jointing.** DD&C E-in-C's Branch Information Sheet Vol-111, Sheet No. IS- Svcs-347 to IS-Svcs-354 shall be referred for sealing of the joints and slab_core-cuts for internal sewerage system, which indicate all steps to be carried out and are self- explanatory. Keeping in view the leakage / seepage issues on a very large scale in the recent years, it is recommended that jointing techniques for uPVC pressure pipes should be applied in internal sewerage system network to cutoff this issue. General steps for three most common types of jointing techniques are as under:-

20.5.4.1 **Solvent Cement Joint.** Procedure is as under:-

(1) Chamfer the pipe end at an angle of 15 to 20 to an extent of 0.75mm length.

(2) Remove the dust and burr from the pipe ends and fittings using dry rag and thoroughly clean with the cleaner.

(3) Spread solvent cement thinly and evenly over spigot end and inside of socket.

(4) Assemble within 40 seconds.

(5) Hold together for 3-5 minutes.

(6) Wipe all excessive adhesive.

(7) Leave for 48 hours before testing.

(8) Excessive use of solvent cement could lead to weakening the pipe wall by solvent action. The tools required for solvent cement jointing comprise of cutting tool, rags, knife or half round coarse file, natural bristle, primer, application can, lubricant, solvent cement and tool tray. The solvent consumption for single joint of pipes and its respective fittings is given in table 20-4.

(9) The setting time for solvent cement joint is given in table 20-5.

(10) The procedure for solvent cement joint is shown in the figure 20-1.

**TABLE 20-4**
**Quantity of Solvent**

| **Siff$_1$ mm)** | **38-50** | **63-76** | **101** | **101 -152** | **178 -203** |
|---|---|---|---|---|---|
| **Cleaner (ml)** | 6 -10 | 10 - 20 | 30 - 50 | 68- 90 | 100 - 120 |
| **Lubricant (gm)** | 20 -23 | 35-40 | 40-50 | 50- 68 | 70 - 80 |
| **Solvent Cement (ml)** | 14- 20 | 20 -40 | 60 - 100 | 128 - 175 | 180 - 220 |

**TABLE 20-5**
**Setting Time**

| **Ambient Temperature** {OC) | **Pipe Diameter** (mm) | **Waiting** Time **Before Installation (Minute)** | **Time During Which the Joint Should not be Moved {Seconds)** |
|---|---|---|---|
| >20 | <63 | 10 | 40 |
| | >75 | 15 | 70 (1.10 Minutes) |
| 10 - 20 | <63 | 20 | 200 (3.20 Minutes) |
| | >75 | 30 | 360 (6 Minutes) |

Step-1:
Roughing of surface

Step-3:
Application of
solvent inside

Step-2:
Application of
solvent on external
surface

Step-4:
Fixing together

**FIGURE 20-1: SOLVENT CEMENT JOINT**

20.5.4.2 **Z-Jointing System.** The Z-joint possesses the following sealing mechanism:-

(1) Due to the cavity between the lip and the body of the sealing element, the internal water pressure pushes the body of the ring into the groove and the lip to the inside diameter of the pipe thus giving an excellent sealing.

(2) The gap between the groove and the body of the rubber ring is small because their profiles match.

(3) The contact surface between the ring and the inside of the pipe diameter is relatively large because of the lip's Length. (Z-joints and other lip sealing rings are normally loose components of the joint.)

(4) The procedure for Z-jointing system is as under:-

(a) Carefully clean the socket, groove, rubber ring and beveled spigot end until they are completely dry and free of dirt. (This is extremely important for the correct positioning of the rubber ring during assembly).

(b) Press the rubber ring into a heart shape and fit carefully into the groove, pushing it firmly in as far as it goes all the way round. The opening in the rubber ring must face backwards.

(c) Apply lubricant generously to the beveled spigot end and a little to the front edge of the rubber ring. Ensure that no lubricant penetrates behind the rubber ring.

(d) Press the spigot end into the socket, rotating it gently to align the chamfer with the rubber ring. Do not insert the spigot at an angle.

(e) Stop at the entry mark (13-25mm) from the end of the socket to cater for potential expansion and contraction.

(f) Make sure that the pipes to be jointed are aligned correctly against each other.

20.5.5 **Internal Sewerage Network Testing.** Test will be carried out after 48 hour of jointing to allow a proper time for setting. First of all the drain pipes entering into the manholes / gully traps / grease traps shall be made water tight with end caps (extra length be kept for test). All ends of main pipes and its branches except the most elevated end should be closed in such a way to ensure water tightening. A visible colour pigment of approved quality mixed in water to make the dissolved concentrated liquid will be poured from the elevated open end. The detail is shown in figure 20-2.

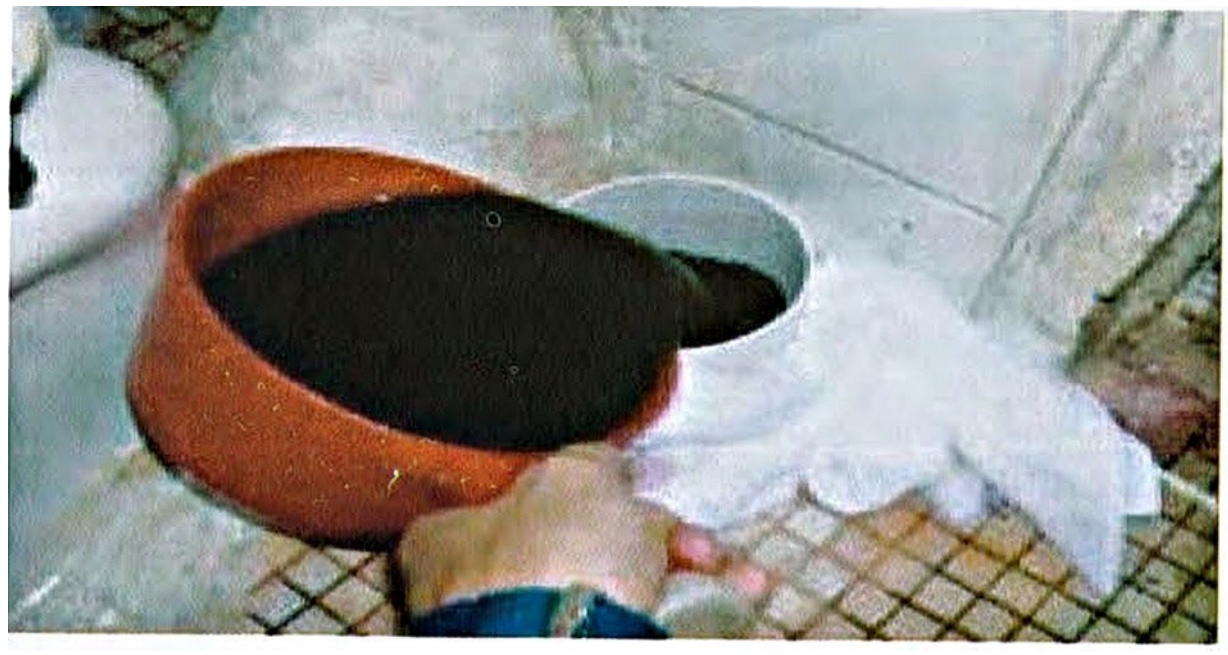


**FIGURE 20-2** : **INTERNAL SEWERAGE NETWORK TEST**

20.5.5.1 Fill the entire pipe and its subsidiaries / branches with this coloured / pigmented water up to the most elevated opened.

20.5.5.2 At least 24 hour's observations be made for any drawdown. In case of drop in water level, carefully find the location of leaked / defective joints / pipes and mark them with permanent marker. After rectifying the defective joints, repeat the test. The permissible drop after 24 hours should not be more than 75mm and keep the open end covered to prevent evaporation losses. After performing the test, the extra lengths of pipes be cut off up to desired lengths. For this testing, colour pigment/ chemical, sealants and water tight end caps etc. shall be provided by the contractor. Contractor will get a certificate regarding satisfactory ex-filtration test from the Engineer-in- charge before concealing / commissioning of sewerage pipes network. The Contractor will be responsible for any disturbance / damage to the sewerage network during and after this test up to maintenance period.

20.5.5.3 **Colour Pigment Test.** The colour pigment test is an inexpensive and effective method for detecting any defect in sanitary fittings and drainage works. For the sake of health and safety, food dye may be used. Colour dye in powder or liquid form should be dissolved or diluted in water for tracing the source of seepage. It should be noted that colour dye seepage will discolour and stain the ceiling.

20.5.5.4 **Individual Fitting Testing.** About 10 liters of colour water is needed for each test. Pour colour water into the outlet of the sanitary fittings to resemble actual use of the fittings. Prepare the colour water in the receptacle / container as shown in the figure 20-3. Afterwards observe whether colour seepage will appear on the ceiling of the lower flat. Colour water seeping through the concrete floor slab will take about an hour or sometimes two weeks to finally appear on the ceiling. Apply colour water to detect any leakage in the components of a floor drain, a bath tub or a shower tray step by step (changing the colour to distinguish one test from another) as shown in the figure 20-3:-

**FIGURE 20-3: INDIVIDUAL FITTING TEST**

20.5.5.5 Defective drainage piping within upper floor slab:-

(1) Seepage is below a sanitary fitment in the kitchen or bath room.
(2) Seepage is intermittent and circular in shape.
(3) Seepage is below discharge pipe.
(4) Seepage is moldy and smelly to indicate foul water.

20.5.5.6 Damaged water proofing in upper floor slab of flat:-

(1) Seepage is below bathroom.
(2) Seepage is below surface channel or wet floor slab (shower room).
(3) Seepage area is relatively large and even, or near the wall.

20.5.5.7 Leaking water supply piping in upper floor slab:-

(1) Seepage forms dripping.
(2) Seepage contains greyish crystalline deposits to indicate salt water

## METHOD OF MEASUREMENTS

**20.6. Pipe Works generally shall be Measured:-**

(1) Net overall length of pipes and fittings as fixed, except, where otherwise indicated.
(2) Fittings shall be enumerated as described.
(3) Fitting of unequal bores shall be classified according to the larger bore.

## CLARIFICATION OF RATES

**20.7.** The rates, inter alia, include particularly:-

(1) Fixing complete in long or short lengths, including running joints in the length.
(2) Fittings like bends, double sockets and tee shall be paid separately.
(3) Fixing Soil, Waste and Ventilation pipes.
(4) Distance pieces; supported or unsupported.
(5) Making good surfaces disturbed.
(6) Cutting holes in walls, roofs and making good.

**20.8.** The contractor shall provide lead and gasket.

## ITEM RATES

| Sl No | Description | Unit | Rates (Rs)I |
|---|---|---|---|
| | **Soil Waste andVentilation, Pipes(Cl-Spun)** | | |
| 20-1 | Supply and fix, **Cl SWV pipe 75 mm bore,** all as specified. | Metre | 2327 |
| 20-2 | Same as item 20-1, but **100 mm bore.** | Metre | 2833 |
| 20-3 | Same as item 20-1, but 150 mm bore. | Metre | 5202 |
| 20-4 | Supply and fixing **Cl SWV pipe 75 mm bore** but except cost of pipes. | Metre | 506 |
| 20-5 | Same as item 20-4, but **100 mm bore.** | Metre | 553 |
| 20-6 | Same as item 20-4, but **150 mm bore.** | Metre | 758 |
| 20-7 | Add to item 20-1 to 20-6 or, if fixed in repair. | Metre | 139 |
| | **Fittings - (Cl-Spun) Bends** | | |
| 20-8 | Supply and fix, **Cl plain bend 75 mm bore** joints filled with lead, all as specified. | Each | 1961 |
| 20-9 | Same as item 20-8, but **100 mm bore.** | Each | 2500 |
| 20-10 | Same as item 20-8, but **150 mm bore.** | Each | 5694 |
| 20-11 | Supply and fix, **Cl plug bend 75 mm bore** joints filled with lead, as specified. | Each | 2291 |
| 20-12 | Same as item 20-11 but **100 mm bore.** | Each | 2680 |
| 20-13 | Same as item 20-11 but **150 mm bore.** | Each | 6295 |
| 20-14 | Supply and fix, **Cl plain and plug bends 75 mm bore** joints filled with lead, but except cost of plain and plug bends, all as specified. | Each | 791 |
| 20-15 | Same as item 20-14, but **100 mm bore.** | Each | 1000 |
| 20-16 | Same as item 20-14, but **150 mm bore.** | Each | 1525 |
| 20-17 | Supply and fix, **Cl plain T 75 mm bore** joint filled with lead, all as specified. | Each | 2472 |
| 20-18 | Same as item 20-17, but **100 mm bore.** | Each | 3559 |
| 20-19 | Same as item 20-17, but **150 mm bore.** | Each | 7669 |
| 20-20 | Supply and fix, **Cl, plug T 75 mm** joint filled with lead, all as specified. | Each | 2804 |
| 20-21 | Same as item 20-20, but **100 mm bore.** | Each | 3829 |
| 20-22 | Same as item 20-20, but **150 mm bore.** | Each | 8419 |
| 20-23 | Supply and fix, **Cl, Y-T 75 mm bore** joint filled with lead, all as specified. | Each | 3281 |
| 20-24 | Same as item 20-23, but **100 mm bore.** | Each | 3949 |
| 20-25 | Same as item 20-23, but **150 mm bore.** | Each | 8419 |
| 20-26 | Supply and fix, **Cl, plain T, plug T and Y-T 75mm bore,** joints filled with lead, but except cost of plain tee, plug tee and Yee tee. | Each | 1272 |
| 20-27 | Same as item 20-26, but **100 mm bore.** | Each | 1579 |
| 20-28 | Same as item 20-26, but **150 mm bore.** | Each | 2449 |
| | **Reduced Fittings (Cl - Spun)** | | |
| 20-29 | Supply and fix, **Cl reducer socket 100 mm x 50 mm bore,** joints filled with lead, as specified. | Each | 2372 |
| 20-30 | Same as item 20-29 but **100 mm x 75 mm bore.** | Each | 2641 |
| 20-31 | Supply and fix, **Cl reducer socket 100 mm x 50 mm / 75 mm** bore, joints filled with lead, but except cost of reducer socket to item 20-29 and 20-30, as specified. | Each | 1000 |
| 20-32 | Supply and fix, **Cl reducer plain T 100 mm x 50 mm / 75 mm** bore, joints filled with lead, as specified. | Each | 3252 |
| 20-33 | Same as item 20-32 but **plug T.** | Each | 3522 |
| 20-34 | Same as item 20-32 but **Y-T.** | Each | 3642 |
| 20-35 | Supply and fix, **Cl reducer T 100 mm x 50 mm / 75 mm bore,** joints filled with lead, but except cost of **reducer T** to item 20-32, 20-33 and 20-34, as specified. | Each | 1272 |

| Sl No | Description | Unit | Rates (Rs)l |
|---|---|---|---|
| | **Cowls - (CI- Spun)** | | |
| 20-36 | Supply and fix, **Vent guard** / **Cowl** over out let of down pipes or top of ventilating pipes etc., fixed complete, dome or balloon pattern, **75 mm bore.** | Each | 1100 |
| 20-37 | Same as item 20-36, but **100 mm bore.** | Each | 1227 |
| 20-38 | Same as item 20-36 or 20 37, but fixing only. | Each | 50 |
| 20-39 | Add to item 20-36 to 20-38 if fixed in repair. | Each | 30 |
| | P/S Traps (CI - Spun) | | |
| 20-40 | Supply and fix **CI Spun P-trap, 100 mm dia,** all as specified. | Each | 2527 |
| 20-41 | Same as item 20-40, but **75 mm dia.** | Each | 1923 |
| 20-42 | Supply and fix **CI Spun S-trap, 100 mm dia.** | Each | 4042 |
| 20-43 | Same as item 20-42, but **75 mm dia.** | Each | 3957 |
| **20-44** | Same as item 20-42, but **50 mm dia.** | Each | 3868 |
| | **uPVC - Soil and Waste Pipes** | | |
| 20-45 | Supply and fix, **u-PVC Soil and waste pipe 50 mm dia,** complete with Z joint and rubber ring, all as specified. | Metre | 360 |
| 20-46 | Same as item 20-45 but **75 mm dia.** | Metre | 512 |
| 20-47 | Same as item 20-45 but **110 mm dia.** | Metre | 727 |
| 20-48 | Same as item 20-45 but **160 mm dia.** | Metre | 1028 |
| 20-49 | Supply and fix, **u-PVC, Soil and waste pipe 50 mm dia,** complete, with plain end and solvent cement joint, all as specified. | Metre | 363 |
| 20-50 | Same as item 20-49, but **75 mm dia.** | Metre | 587 |
| 20-51 | Same as item 20-49, but **110 mm dia.** | Metre | 773 |
| 20-52 | Same as item 20-49, but **160 mm dia.** | Metre | 1420 |
| 20-53 | Same as item 20-49, but **200 mm dia.** | Metre | 1552 |
| 20-54 | Same as item 20-49, but **300 mm dia.** | Metre | 2374 |
| | **uPVC - Vent Pipes** | | |
| 20-55 | Supply and fix, **u-PVC Vent pipe 50 mm dia,** complete with Z joint and rubber ring, all as specified. | Metre | 337 |
| 20-56 | Same as item 20-55 but **75 mm dia.** | Metre | 512 |
| 20-57 | Same as item 20-55, but **110 mm dia.** | Metre | 727 |
| 20-58 | Supply and fix, **u-PVC Vent pipe 50 mm dia,** complete with plain end and solvent cement joint, all as specified. | Metre | 363 |
| 20-59 | Same s item 20-58, but **75 mm dia.** | Metre | 587 |
| 20-60 | Same as item 20-58, but **110 mm dia.** | Metre | 817 |
| 20-61 | Same as item 20-45, 20-49, 20-55, 20-58 but fixing only **50 mm dia.** | Metre | 43 |
| 20-62 | Same as item 20-46, 20-50, 20-56, 20-59, but fixing only **75 mm dia.** | Metre | 50 |
| 20-63 | Same as item 20-47, 20-51, 20-57, 20-60, but fixing only, **110 mm dia.** | Metre | 59 |
| 20-64 | Same as item 20-48, 20-52, 20-53 and 20-54, but fixing only **160 mm, 200 mm, 300 mm dia.** | Metre | 79 |
| 20-65 | Add to item 20-45, 20-49, 20-55, 20-58, 20-61, if fixed in repair, **50 mm dia.** | Metre | 26 |
| 20-66 | Add to item 20-46, 20-50, 20-56, 20-59, 20-62, if fixed in repair, **75 mm dia.** | Metre | 30 |
| 20-67 | Add to item 20-47, 20-51, 20-57, 20-60, 20-63, if fixed in repair, **110 mm dia.** | Metre | 36 |
| 20-68 | Add to item 20-48, 20-52, 20-53, 20-54, 20-64, if fixed in repair, **160 mm dia, 200 mm dia, 300 mm dia.** | Metre | 48 |
| | **Fittings (uPVC)** | | |
| 20-69 | Supply and fix, **uPVC Elbow/bend, 90° 50 mm dia,** complete with Z joint and rubber ring, all as specified. | Each | 175 |
| 20-70 | Same as item 20-69, but **75 mm dia.** | Each | 298 |
| 20-71 | Same as item 20-69, but **110 mm dia.** | Each | 447 |

| Sl No | Description | Unit | Rates (Rs)j |
|---|---|---|---|
| 20-72 | Same as item 20-69, but **160 mm dia.** | Each | 1085 |
| 20-73 | Supply and fix, **uPVC Elbow/bend, 45° 50 mm,** complete with Z joint and rubber ring, all as specified. | Each | 165 |
| 20-74 | Same as item 20-73, but **75 mm dia.** | Each | 273 |
| 20-75 | Same as item 20-73, but **110 mm dia.** | Each | 416 |
| 20-76 | Same as item 20-73, but **160 mm dia.** | Each | 920 |
| 20-77 | Supply and fix, **uPVC Elbow/bend, 90° 50 mm dia,** complete with solvent cement joint, all as specified. | Each | 168 |
| -78 | Same as item 20-77, but **75 mm dia.** | Each | 376 |
| 20-79 | Same as item 20-77, but **110 mm dia.** | Each | 621 |
| 20-80 | Same as item 20-77, but **160 mm dia.** | Each | 2128 |
| 20-81 | Supply and fix, **uPVC Elbow/bend 45°, 50 mm dia.,** complete with solvent cement joint, all as specified. | Each | 127 |
| 20 82 | Same as item 20-81, but **75 mm dia.** - | Each | 213 |
| 20-83 | Same as item 20-81, but **110 mm dia.** | Each | 325 |
| 20-84 | Same as item 20-81, but **160 mm dia.** | Each | 787 |
| 20-85 | Supply and fix, **Socket 50 mm dia,** complete with Z joint and rubber ring·, all as specified. | Each | 147 |
| 20-86 | Same as item 20-85, but **75 mm dia.** | Each | 248 |
| 20-87 | Same as item 20-85, but **110 mm dia.** | Each | 339 |
| 20-88 | Same as item 20-85, but **160 mm dia.** | Each | 769 |
| 20-89 | Supply and fix, **Socket 50 mm dia** complete with solvent cement joint, as specified. | Each | 109 |
| 20-90 | Same as item 20-89, but **75 mm dia.** | Each | 188 |
| 20-91 | Same as item 20-89, but **110 mm dia.** | Each | 248 |
| 20-92 | Same as item 20-89, but **160 mm dia.** | Each | 636 |
| 20-93 | Supply and fix, **Eccentric Reducer 50 mm x 75 mm dia,** complete with solvent cement joint, all as specified. | Each | 208 |
| 20-94 | Same as item 20-93 but 50 mm x 110 mm dia. | Each | 237 |
| 20-95 | Same as item 20-93 but **75 mm x 110 mm dia.** | Each | 231 |
| 20-96 | Same as item 20-93 but **110 mm x 160 mm dia.** | Each | 806 |
| 20-97 | Supply and fix, **uPVC Equal T 50 mm dia,** complete with Z joint and rubber ring, all as specified. | Each | 320 |
| 20-98 | Same as item 20-97, but **75 mm dia.** | Each | 573 |
| 20-99 | Same,as item 20-97, but **110 mm dia.** | Each | 745 |
| 20-100 | Supply and fix **uPVC Y-T, 50 mm dia,** complete with Z joint and rubber ring all as specified. | Each | 389 |
| 20-101 | Same as item 20-100, but **75 mm dia.** | Each | 616 |
| 20-102 | Same as item 20-100, but **110 mm dia.** | Each | 814 |
| 20-103 | Same as item 20-100, but **160 mm dia.** | Each | 2614 |
| 20-104 | Supply and fix, **uPVC Equal T, 50 mm dia,** complete with solvent cement joint, all as specified. | Each | 226 |
| 20-105 | Same as item 20-104, but **75 mm dia.** | Each | 438 |
| 20-106 | Same as item 20-104, but **110 mm dia.** | Each | 563 |
| 20-107 | Same as item 20-104, but **160 mm dia.** | Each | 2114 |
| 20-108 | Supply and fix, **uPVC, Access/ door T 75 mm dia,** complete with solvent cement joint, all as specified. | Each | 788 |
| 20-109 | Same as item 20-108, but **110 mm dia.** | Each | 1824 |

| Sl No | Description | Unit | Rates (Rs)j |
|---|---|---|---|
| 20-110 | Supply and fix, **uPVC, Y-T, 50 mm dia,** complete with solvent cement joint, all as specified. | Each | 374 |
| 20-111 | Same as item 20-110, but **75 mm dia.** | Each | 780 |
| 20-112 | Same as item 20-110, but **110 mm dia.** | Each | 1355 |
| 20-113 | Same as item 20-110, but **160 mm dia.** | Each | 3464 |
| 20-114 | Supply and fix, **uPVC Reducer T, 75 mm to 110 mm dia,** complete with Z joint and rubber ring, all as specified. | Each | 704 |
| 20-115 | Same as item 20-114 but **ReducerY-T, 75 mm x 110 mm dia.** | Each | 704 |
| 20-116 | Same as item 20-114 but **ReducerY-T 110 mm x 160 mm dia.** | Each | 2348 |
| 20-117 | Supply and fix, **uPVC Reducer T, 75 mm x 110 mm dia,** complete with solvent cement, all as specified. | Each | 390 |
| 20-118 | Same as item 20-117 but **110 mm x 160 mm dia.** | Each | 902 |
| 20-119 | Supply and fix, **uPVC Reducer Y-T, 110 mm x 160 mm dia,** complete with solvent cement joint, all as specified. | Each | 1502 |
| 20-120 | Same as item 20-119 but **75 mm x 110 mm dia.** | Each | 522 |
| 20-121 | Same as item 20-119 but **75 mm x 160 mm dia.** | Each | 1318 |
| 20-122 | Fixing only **uPVC, bend elbow, socket, eccentric reducer etc. 50 mm dia.** | Each | 43 |
| 20-123 | Same as item 20-122, but **75 mm dia.** | Each | 50 |
| 20-124 | Same as item 20-122, but **110 mm dia.** | Each | 60 |
| 20-125 | Same as item 20-122, but **160 mm dia.** | Each | 79 |
| 20-126 | Add to item 20-122, byt if fixed in repair. | Each | 26 |
| 20-127 | Add to item 20-123, but if fixed in repair. | Each | 30 |
| 20-128 | Add to item 20-124, but if fixed in repair. | Each | 36 |
| 20-129 | Add to item 20-125, but if fixed in repair. | Each | 48 |
| 20-130 | Fixing only, **uPVC, Equal T, Y-T, ReducerT and T etc. 50 mm dia.** | Each | 86 |
| 20-131 | Same as item 20-130, but **75 mm dia.** | Each | 99 |
| 20-132 | Same as item 20-130, but **110 mm dia.** | Each | 119 |
| 20-133 | Same as item 20-130, but **160 mm dia.** | Each | 158 |
| 20-134 | Add to item 20-130, but if fixed in repair. | Each | 51 |
| 20-135 | Add to item 20-131, but if fixed in repair. | Each | 59 |
| 20-136 | Add to item 20-132, but if fixed in repair. | Each | 71 |
| 20-137 | Add to item 20-133, but if fixed in repair. | Each | 96 |
| 20-138 | Supply and fix, **uPVC Vent Cowl 50 mm dia** on top of ventilating pipes. | Each | 107 |
| 20-139 | Same as item 20-138 but **75 mm dia.** | Each | 125 |
| 20-140 | Same as item 20-138 but **110 mm dia.** | Each | 143 |
| 20-141 | Same as item 20-138 to 20-140, but fixing only. | Each | 50 |
| 20-142 | Add to item 20-138 to 20-141, if fixed in repair. | Each | 30 |
| 20-143 | Supply and fix, **uPVC Floor Trap, 100 mm dia.** | Each | 876 |
| 20-144 | Supply and fix, **uPVC P-trap 75 mm dia.** | Each | 550 |
| 20-145 | Same as item 20-144 but **100 mm dia.** | Each | 697 |
| 20-146 | Deduct from items, if rubber ring/ gasket not used, all as specified, | Metre | 107 |
| 20-147 | Deduct from items, if lead not used, all as specified. | Metre | 150 |

# SECTION-21

# EXTERNAL SEWERAGE AND DRAINAGE

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-21

# EXTERNAL SEWERAGE AND DRAINAGE

## SPECIFICATIONS

**21.0.** This section consists of all operations related to external sewerage and drainage using RCC pipes (ASTM Specifications/ BS), Manholes and Sludge pumps.

## MATERIAL REQUIREMENTS

**21.1. Reinforced Cement Concrete (RCC) Pipes.** The pipes shall be RCC obtained from approved manufacturers and shall conform to following Specifications:-

21.1.1. **R.C.C. Pipes (BSS - 785 &1144).** These shall conform to specifications given in Table 21-1 and details shown in Figure 21-1.

**TABLE 21-1**

**RCC Pipe Based on BSS - 785 &1144**

| S.No | Internal Dia | | Wall Thickness | | Circular Reinforcement | | Longitudinal Reinforcement on Respective Cage | | |
|---|---|---|---|---|---|---|---|---|---|
| | mm | in | mm | In | Size of Bars | No. of Rings | Size of Bars | | No. of Bars |
| | | | | | | | Mm | In | |
| 1 | 100 | 4 | 25 | 1 | 10SWG | 11 | 5 | 3/16 | 6 |
| 2 | 150 | 6 | 25 | 1 | 10SWG | 11 | 5 | 3/16 | 6 |
| 3 | 230 | 9 | 25 | 1 | 3/16" | 7 | 5 | 3/16 | 6 |

**Notes:-**

(1) One extra ring at both edges of the pipe for minimizing damage during handling.
(2) Concrete strength must not be less than 3000 psi.
(3) Standard length of pipe is 1.82 M (6'- 0").
(4) Standard width of collar for pipe internal diameter 100-230mm is 150mm.
(5) Either ring of specified gauge/ size is provided or Spiral of specified gauge/ size is used.

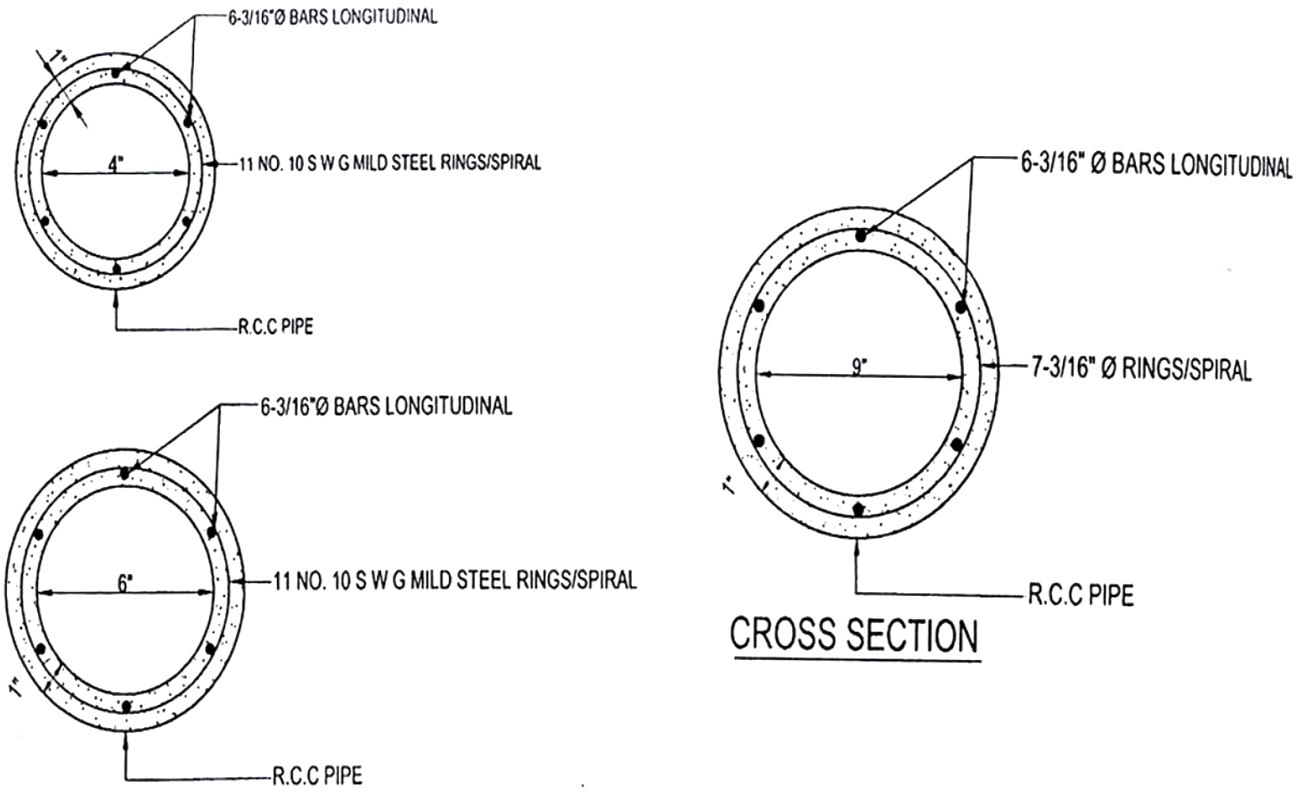



FIGURE: 21-1

21.1.2. **R.C.C. Pipes (Based on ASTM C-76).** These shall conform to specifications given in Table 21-2 and details shown in Figure 21-2.

**TABLE 21-2**

**R.C.C Pipe Class II Wall "B" (4000 Psi) Based on ASTM C-76**

| Ser | Internal Dia (D) | | Wall Thickness (D) | | Circular Reinforcement | | | | | Longitudinal Reinforcement on respective cage | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Size of Bars | | No of Rings | | | Size of Bars | No of Bars | | |
| | | | | | | | Inner Cage+ Bell | Elliptical Cage | Outer Cage | | Inner Cage | Elliptical cage | Outer cage |
| | Mm | Inch | mm | Inch | mm | Inch | | | | mm | | | |
| (1) | 300 | 12 | 51 | 2 | 5 | 3/16 | 21+3 | - | - | 5 | 5 | - | - |
| (2) | 375 | 15 | 57 | 2 1/4" | 5 | 3/16 | 21+3 | - | - | 5 | 5 | - | - |
| (3) | 450 | 18 | 63 | 2½" | 5 | 3/16 | 21+3 | 21 | - | 5 | 5 | 5 | - |
| (4) | 525 | 21 | 70 | 2¾" | 5 | 3/16 | 21+3 | 21 | - | 5 | 6 | 5 | - |
| (5) | 600 | 24 | 76 | 3 | 5 | 3/16 | 21+3 | 21 | - | 5 | 6 | 6 | - |
| (6) | 675 | 27 | 82 | 3¼" | 6 | 1/4 | 22 | 19 | - | 6 | 7 | 7 | - |
| (7) | 750 | 30 | 89 | 3½" | 6 | 1/4 | 24 | 19 | - | 6 | 7 | 7 | - |
| (8) | 825 | 33 | 95 | 3¾" | 6 | 1/4 | 27 | 21 | - | 6 | 7 | 7 | - |
| (9) | 900 | 36 | 101 | 4" | 6 | 1/4 | 19 | 21 | 15 | 6 | 8 | 8 | 8 |
| (10) | 1050 | 42 | 115 | 4½" | 6 | 1/4 | 27 | 27 | 21 | 6 | 8 | 8 | 8 |
| (11) | 1200 | 48 | 127 | 5 | 6 | 1/4 | 32 | 32 | 26 | 6 | 8 | 8 | 8 |
| (12) | 1350 | 54 | 140 | 5½" | 6 | 1/4 | 38 | 38 | 27 | 10 | 9 | 9 | 9 |
| (13) | 1500 | 60 | 152 | 6 | 6 | 1/4 | 48 | 48 | 32 | 10 | 9 | 9 | 9 |
| (14) | 1650 | 66 | 165 | 6½" | 10 | 3/8 | 24 | 24 | 17 | 10 | 10 | 10 | 10 |
| (15) | 1800 | 72 | 178 | 7 | 10 | 3/8 | 27 | 27 | 19 | 10 | 10 | 10 | 10 |
| (16) | 1950 | 78 | 190 | 7½" | 10 | 3/8 | 32 | 32 | 22 | 10 | 11 | 11 | 11 |
| (17) | 2100 | 84 | 203 | 8 | 10 | 3/8 | 38 | 38 | 25 | 10 | 11 | 11 | 11 |
| (18) | 2250 | 90 | 216 | 8½" | 10 | 3/8 | 38 | 43 | 27 | 10 | 12 | 12 | 12 |

**Notes:-**

(1) Bell and spigot joints will be used from 12" (300mm) diameter to 24"(600mm) dia size with Rubber gaskets.
(2) Tongue and Groove joint will be used from 27" (675 mm) internal dia and above.
(3) Grade 40 steel conforming to specifications A-615 be used.
(4) Refer Drawing#. E-in-C Branch (DD&C) MISC /A/19-2004 Sheet No. Svcs/ SEW -1/3

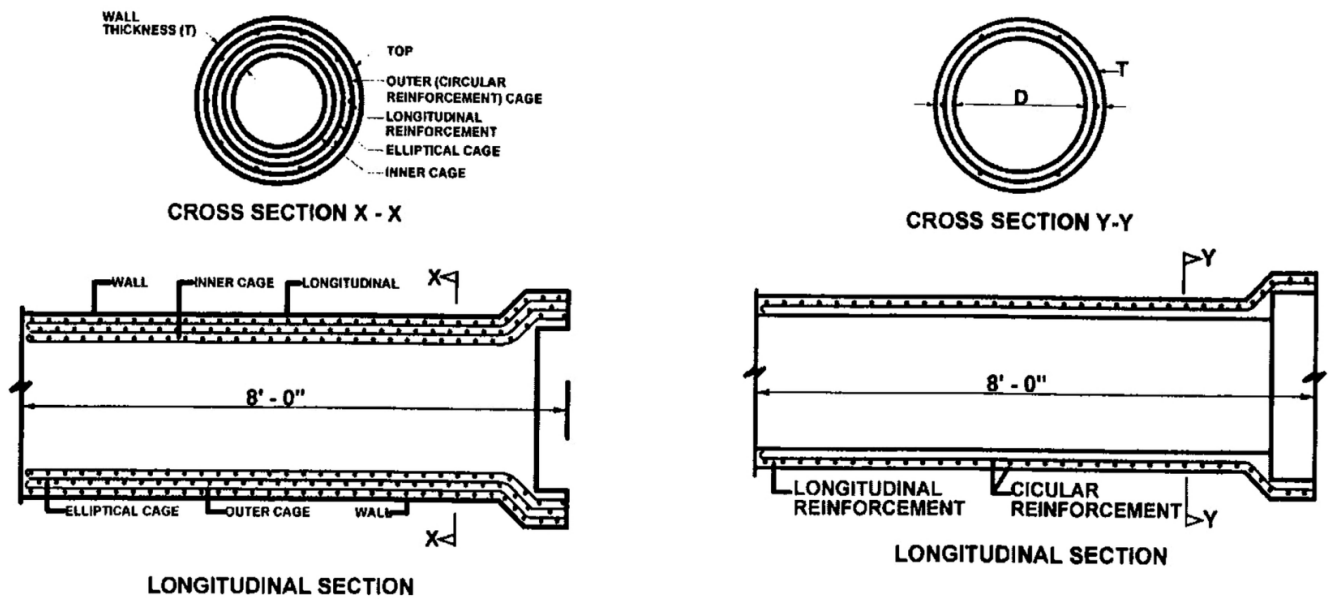



**FIGURE: 21-2**

**21.2. Galvanizing.** Galvanizing shall be a thorough with an even coat of zinc, free from stains, bare spots or defects.

**21.3. Wire Guards.** To be of stout wire, galvanized after manufacture, dome or balloon pattern as ordered, to be fixed over outlets of down pipes or tops of ventilating pipes.

**21.4. Sludge Pumps.** These shall be of capacity and size as specified by the manufacturers and will be from the Engineer-in-Chief approved list:-

21.4.1. **Horizontal Non Clogging Pumps**

(1) Capacity
  (a) 250 to 275 gpm
  (b) 0.5 Cusecs to 2.00 Cusecs
(2) Head - 6 M to 15 M
(3) Trolley mounted (Mobile} and permanently installed.
(4) The pumps are driven by diesel engine or electric motor.
(5) The Pumps are useful for:-
  (a) Activated sludge pumping stations.
  (b) Storm water pumping stations.
  (c) They are also useful for similar activity like disposal of industrial and chemical effluents and other industrial wastes.

21.4.2. **Submersible Pumps for Fountains / Dewatering / Drainage, Non-clogging submersible pumps for Sludge / Sewage.**

(1) For Sludge / Sewage
  (a) Size - upto 10".
  (b} Capacity - upto 1000 cum / hr (3750 gpm)
  (c) Head - 60 ft and above.
(2) For Fountains / Dewatering / Drainage.
  (a) Size - upto 4".
  (b) Capacity - upto 111 cum/ hr (400 gpm).
  (c) Head - upto 200 ft.
(3) Pumps are of short, compact design as a result of the effective seal between the motor and the hydraulic section.
(4) **Built-in cooling system on all pumps.** The back vanes of the impeller circulate cooling water around stator housing.
(5) Double mechanical face seals provide necessary isolation between electric motor and the pumped liquid. The seal surfaces are made of extremely wear resistant materials.
(6) The impeller in case of non-clogging pumps has a large through let allowing passage of large particles and thus reducing the risk of clogging.
(7) Pumps are mainly used for pumping sewage, waste water and storm water in municipal pumping stations.
(8) Pump has a multi-vane open or semi-open impeller available in different materials i.e. Cast iron, bronze and stainless steel etc. It is specially designed to handle media containing highly abrasive material such as clay, sand, drilling dust etc.
(9) For installation of pumps piping and other work shall be paid under respective section.

## CONSTRUCTION REQUIREMENTS

### 21.5. Laying of RCC Pipes

21.5.1. The pipes shall be laid according to the gradients required, in straight line manhole to manhole. The pipes shall rest on PCC 1:2:4 saddles, pre-cast/cast in situ at distances as directed. Any change in direction shall take place inside the manhole by the use of curved main half round channels; similar changes in internal diameter of sewage pipes shall be made in manhole by the use of taper half round channels, straight or curved as necessary, and NOT by the use of tapers or bend in the sewage line outside the manhole.

21.5.2. Lay not more than 6 lengths of pipes to the required gradient, fill in the groove and end of each pipe jointed with rubber ring, spun or hemp yarn soaked in molten bitumen, jute chopped composition of soap. The hemp will be of a size sufficient to fill the groove while pressed. These six lengths of joints of pipes should be pressed tight by means of jack and the loose collars slide over the joints of two pipes and kept concentric by means of few wooden wedges. CM 1:1 is then pressed into the joints and edges finished off with a beveled joint. Laying and jointing will be carried out in sets of not more than 6 pipes each time.

21.5.3. When a flexible water tight joint with the use of rubber gasket is specified, the laying of pipes shall correspond to the respective ASTM Specification.

**21.6. Concrete for Cover, Benching etc.** The concrete for benching and pre-cast covers, to manholes etc, is to be composed of one part of cement, two parts of sand and four parts of 19mm graded aggregate. The concrete in main and branch benching be trowelled upto a smooth hard face with steel trowel, adding additional cement as required. Benching to be brought upto an average height of 250mm above main invert level, so as to ensure quick fall towards various channels.

**21.7. Foundation Concrete.** Concrete in foundations under drains, manholes, traps, gullies etc. to be PCC 1:3:6 or 1:4:8 as may be ordered or shown on the drawings. The composition, mixing and laying to conform to conditions laid down in Section-3 (Concrete).

**21.8. Foundation Beds to Drains.** The concrete beds to be 100mm thick under collars of pipes and 300mm wider than internal dia of the pipes. After the pipes are laid and tested, they are to be hunched with similar concrete. The hunching to extend from the edges of the foundation concrete to at least half way up the sides of the pipes and include packing solid under the pipes.

**21.9. Gullies**

21.9.1. To be glazed-ware and set truly in level and jointed to drain pipes in CM (1:1). Gullies to be encased in PCC 1:4:8.

21.9.2. Cleaning eyes are to be provided to gullies, when the distance between the gully and the manhole exceed 6M.

**21.10. Interception Chambers.** To be as described for manholes, but to incl an intercepting trap of approved pattern, with cleaning arm, having an approved stopper fitted with a GI lever and chain complete. This strap be carefully bedded in concrete on the discharge side of the manhole and set, so as to ensure that the normal "drop" from inlet to outlet is preserved.

**21.11. Laying Drains.** Every line of drain shall be accurately laid and be perfectly true to line and gradient from point to point. Every main drain shall be true in line from manhole to manhole and any change in direction shall take place inside the manhole by the use of taper channels, straight or curved as necessary and not by the use of tapers or bend in the line drain, outside the manhole.

**21.12. Manholes.** Manholes will be designed according to the required depth and the number of sewage lines meeting at the point. These shall be constructed in the manner described below:-

(1) Excavate in any soil, make good and dispose off surplus spoil.

(2) Foundations shall be 150mm thick, projection of 150mm beyond outside of the walls and to be PCC 1:4:8.

(3) Bolsters around manhole covers shall be 150mm x150 mm of PCC 1:2:4.

(4) Benching shall be PCC 1:4:8 with main and branch channels formed there-in rising 45 degrees from channel edges and all surfaces shall be trowelled smooth.

(5) Cover slabs shall be of stone or concrete, bedded in CM.

(a) Stone covers shall be 75mm thick of approved strong slab of self faced stone.

(b) PCC 1:2:4 reinforced with 6mm round or square bars at 150mm centers both ways and surfaces and edges finished fair.

(c) PCC of size and reinforced as shown in the drawings for special areas expected to take live loads.

(6) Cover and frame will be bedded in mortar bolstered round with 150 mm x 150 mm, PCC 1:2:4.

(7) Mortar shall be CM 1:3.

(8) Walls shall be either of the following, as ordered or shown on the drawings:-

(a) Burnt brick work 230 mm thick, in CM 1:3.

(b) Approved Rubble stone, 300 mm thick, in CM 1:3.

(c) Solid Concrete blocks, 200 mm thick in CM 1:3.

(d) Poured PCC 1:4:8, 230 mm thick.

(e) R.C.C 1:2:4, 150 mm thick reinforced with 6 mm round bars, 150 mm center to center both ways.

(9) Internal faces of walls shall be hacked for plaster key, cleaned dubbed out with mortar and rendered not less than 13 mm thick with CM 1:3.

(10) If rock is encountered in excavation of the manholes, prior order of the Engineer-in-charge will be obtained before starting excavation. Extra payment for rock will be made under Section-1 "Excavation and Earth work" and the cost of excavation will be deducted at the average rate of ordinary and hard soil rates.

**21.13. Manhole Covers.** Internal diameter of RCC/CI covers shall be as specified.

**21.14. Testing**

21.14.1. It is recommended to test the pipe network in accordance with the prescribed code of practice. Normally, the leakages may occur at the joints. As such, the concealing/ commissioning / backfilling of joints should only be done after testing the pipeline

21.14.2. **Smoke Test.** Smoke testing involves forcing smoke-filled air through a sewer line. The smoke under pressure will fill the main line plus any connections; then follow the path of the leak to the ground surface, quickly revealing the source of the problem. Only enough force to overcome atmospheric pressure is required. Smoke

testing is the most efficient and cost effective way to locate and identify infiltration and exfiltration problems in sewer systems. Smoke testing helps to identify plumbing leaks in buildings. Sewer gases can cause health problems for building occupants. Smoke may be seen coming out of the ground, manholes, or vents and gutters. Smoke coming out of the ground may indicate a break or other defect in the sewer line which allows smoke to escape up through the ground. The details are shown in the figure 21-3.

21.14.2.1. **Blowers.** The Contractor shall provide a portable blower designed and built specifically for the use of smoke testing. The blower shall be self- contained and capable of producing a minimum of 4,500 cubic feet of air per minute. Blowers with less cfm may also be approved by the Engineer-in-Charge provided, it is demonstrated that sufficient pressure is generated for the testing. If inadequate pressure is being generated, then additional blowers (dual blowers) or larger blowers may be required. Adequate pressure is being provided when smoke is exiting the vent stacks as a plume or, where no vent stacks are present, smoke is exiting the upstream/downstream manhole casting/vent hole/pick hole, etc. In general, the larger the pipeline diameter being tested, the higher the smoke blower capacity (cfm) required. The base of the blower shall have appropriate adapters and seals to make a good connection to the manhole without excessive loss of smoke.

21.14.2.2 **Smoke Production.** Smoke fluid, smoke candles, or approved equal, shall produce continuous smoke that can be controlled by the testing crew for the duration of the test. The smoke generated shall be white to gray in color, leave no residue, and shall be non- toxic and non-explosive.

21.14.2.3. Other Equipment in addition to the blower, the Contractor shall provide all other equipment, tools, and incidentals required to perform smoke testing as required by these specifications including, but not limited to, sewer line stoppers, sand bags, cameras, confined space entry equipment, and traffic control equipment.

21.14.2.4. Smoke test will be carried out at contractor's expenses. Test will not be carried out before 48 hours of jointing process to allow a proper time for setting. Contractor will get a certificate regarding satisfactory smoke test from the Engineer - in - charge before concealing / commissioning of SWV pipes network. The contractor will be responsible for any disturbance / damage to the sewerage network during and after smoke test upto maintenance period.

**FIGURE 21-3: SMOKE TEST**

**21.15. Damages etc.** The contractor will be responsible for any disturbance / damage to the sewage lines, even after the test, within the maintenance period.

## METHOD OF MEASUREMENTS

**21.16. Pipe work shall be measured.** Net overall length of pipes and fittings as fixed, except where otherwise indicated.

**21.17. Manholes·.** Internat plan area x height (as defined below):-

(1) Uniform area on plan
Height shall be from invert to top of manhole cover.

(2) With shaft of reduced area

(a) **Chamber height** shall be from invert to junction of shaft with chamber. Internal plan area of chamber.

(b) **Shaft height** shall be from junction of shaft with chamber or top of manhole cover. Internal plan area of shaft.

21.17.1. The internal area of circular manhole shall be internal diameter squared. In calculating internal area of shaft, ignore any corbelling out.

## CLARIFICATION OF RATES

**21.18.** The rates, inter alia, include particularly:-

(1) Fixing complete in long or short lengths, including running joints in the length.
(2) Making good surface disturbed.
(3) Cutting hole in wall/ roof and making good.
(4) Supply and installation of sludge pumps in any position.
(5) Expenses of all leakage tests.

## ITEM RATES

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **RCC - Pipes (BS Specifications)** | | |
| 21-1 | Supply and fix, **RCC pipes 100 mm bore,** laid and jointed with spigot socket or collars, as specified. | Metre | 475 |
| 21-2 | Same as item 21-1, but except cost of pipe, collars fittings. | Metre | 108 |
| 21-3 | Supply and fix, **RCC pipes, 150 mm bore,** laid and jointed with spigot socket or collars, as specified. | Metre | 517 |
| 21-4 | Same as Item 21-3, but except cost of pipes, collars fittings. | Metre | 175 |
| 21-5 | Supply and fix, **RCC pipes 230 mm bore,** laid and jointed with spigot socket or collars, as specified. | Metre | 713 |
| 21-6 | Same as Item 21-5, but except cost of pipes, collars fitting. | Metre | 218 |
| | **RCC - Pipes (ASTM Specifications)** | | |
| 21-7 | Supply and fix, **RCC pipes 300 mm bore,** laid and jointed with spigot socket or tongue and groove joint, include rubber ring, as specified. | Metre | 1289 |
| 21-8 | Same as Item 21-7, **but 375 mm bore.** | Metre | 1622 |
| 21-9 | Same as item 21-7, **but 450 mm bore.** | Metre | 1848 |
| 21-10 | Same as item 21-7, **but 525 mm bore.** | Metre | 2442 |
| 21-11 | Same as item 21-7, **but 600 mm bore.** | Metre | 2587 |
| 21-12 | Same as item 21-7, **but 675 mm bore.** | Metre | 3617 |
| 21-13 | Same as item 21-7, **but 750 mm bore.** | Metre | 5243 |
| 21-14 | Same as item 21-7, **but 825 mm bore.** | Metre | 5918 |
| 21-15 | Same as item 21-7, **but 900 mm bore.** | Metre | 7560 |
| 21-16 | Same as item 21-7, **but 1050 mm bore.** | Metre | 9791 |
| 21-17 | Same as item 21-7, **but 1200 mm bore.** | Metre | 13383 |
| | **Cleaning Eyes** | | |
| 21-18 | Extra over **drains and fittings** for surrounding, up turned junction in 450 x 450 x 600 mm of PCC 1:4:8, provide 450mm x 450 mm x 75 mm PCC 1:4:8 or 65mm self face of cover stone, set and jointed in CM 1:3. | Each | 998 |
| | **Surface Gullies** | | |
| 21-19 | Excavate, to dispose off **surplus spoil** on site, make good the surface disturbed, supply (230 mm x 230 mm x 100 mm out let), surface gullies and bed, and surround in 100mm of PCC 1:4:8, provide 100 mm x 125 mm rounded PCC 1:4:8, curb or 900 mm x 900 mm x100 mm dished PCC 1:4:8, top and 250 x 250 mm galvanized Cl, loose grating, complete. | Each | 2020 |
| | **Testing Drains** | | |
| 21-20 | Provide water and temporary apparatus, test drains till perfect testing using (600 mm to 1800 mm head). | Each | 700 |
| 21-21 | Provide water and temporary apparatus, test manholes, full depth of manholes, but not exceeding 1800 mm. | Each | 1431 |
| 21-22 | Provide apparatus, material, labour etc. and smoke test till perfect testing of soil waste, ventilating pipes and connecting drain to nearest manhole. | Each | 983 |
| 21-23 | Clearing drains by rodding and well flushing between manholes not exceeding 30M. | Each | 1140 |
| 21-24 | Same as item 21-23, but manholes exceeding 30 M and not exceeding 92 M. | Each | 1230 |
| | **Manholes** | | |
| 21-25 | **Manholes, complete, rectangular or circular** as described, not exceeding 600 mm deep from invert to surface of cover, including main channel, set in CM 1:1, **230 mm thick brick walls (except manhole cover).** | Cum | 36267 |
| 21-26 | Same as item 21-25, but **300 mm thick stone walls.** | Cum | 41574 |
| 21-27 | Same as item 21-25, but **230 mm thick poured Concrete walls.** | Cum | 36230 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 21-28 | Same as item 21-25, but **150 mm thick RCC walls.** | Cum | 33058 |
| 21-29 | **Manholes, complete, rectangular or circular** as described, exceeding 600 mm deep but not exceeding 1800 mm deep, with iron steps (in angles 380 mm centres), **230mm thick brick walls (Except manhole cover).** | Cum | 30071 |
| 21-30 | Same as item 21-29, but **300 mm thick stone walls.** | Cum | 30499 |
| 21-31 | Same as item 21-29, but **230 mm thick poured Concrete walls.** | Cum | 29223 |
| 21-32 | Same as item 21-29, but **150 mm thick RCC walls.** | Cum | 24184 |
| | **Manhole Covers** | | |
| 21-33 | Supply and fix, **Manhole CI cover with frame,** 450 mm, circular or rectangular exceeding 7.50kg each, but not exceeding 10kg/each, set in CM and haunching in Concrete, as specified. | Each | 3346 |
| 21-34 | Taking up or down, manhole cover and frame, and removing to store. | Each | 240 |
| 21-35 | Providing and laying, **RCC 1:2:4 Manhole cover (precast)** complete with angle iron frame, embedded in concrete, all as per Information Sheet # Svcs-341 | Each | 5960 |
| 21-36 | Supply and fix, siphon traps, glazed ware in PCC 1:4:8, P or S traps, 100 mm dia | Each | 766 |
| | **Sinking of Well** | | |
| 21-37 | **Sinking of Well,** 2.15 M dia, upto 3 M depth, below sub soil water level. | Metre | 31750 |
| 21-38 | **Cutting into existing Manholes, for connecting new drains,** making good to pipe and rendering, cutting out existing benching and reforming of benching as required for new drain, making good to existing wall etc., complete, **100 mm bore of pipes.** | Each | 533 |
| 21-39 | Same as item 21-38, but **150 mm bore of pipes.** | Each | 610 |
| 21-40 | Same as item 21-38, but **230 mm bore pipes.** | Each | 687 |
| 21-41 | **Cutting into existing manholes for removing branch drains,** making good to walls and rendering, cutting out branch channel, and making good benching complete, **100 mm bore of pipes.** | Each | 441 |
| 21-42 | Same as item 21-41, but **150 mm bore of pipes.** | Each | 481 |
| 21-43 | Same as item 21-41, but **230 mm bore of pipes.** | Each | 584 |
| 21-44 | **Taking up CC or Glazed ware pipes** with or without collars, including fittings, removing to store or cleaning, and stacking for relaying, **100 mm bore pipes.** | Metre | 65 |
| 21-45 | Same as item 21-44, but **150 mm bore pipes.** | Metre | 101 |
| 21-46 | Same as item 21-44, but **230 mm bore pipes.** | Metre | 125 |
| 21-47 | **Breaking up Glazed ware or RCC drain pipes** set in CM and removing off the Mindef premises, if required, **100 mm bore of pipes.** | Metre | 47 |
| 21-48 | Same as item 21-47, but **150 mm bore of pipes.** | Metre | 72 |
| 21-49 | Same as item 21-47, but **230 mm bore of pipes.** | Metre | 89 |
| 21-50 | Taking up carefully, **drain pipes fit for subsequent reuse,** cleaning and stacking within 30M, **100 mm bore of pipes.** | Metre | 47 |
| 21-51 | Same as item 21-50, but **150 mm bore of pipes.** | Metre | 87 |
| 21-52 | Same as item 21-50, but **230 mm bore of pipes.** | Metre | 107 |
| 21-53 | Breaking up **gully traps, disconnecting traps etc.,** set in Concrete and removing off the Mindef premises, if required, **100 mm bore of pipes.** | Each | 83 |
| 2 -54 | Same as item 21-53, but **150 mm bore of pipes.** | Each | 124 |
| 21-55 | Same as item 21-53, but **230 mm bore of pipes.** | Each | 186 |
| 21-56 | Taking up carefully, **cleaning gulley traps, disconnecting traps etc.,** jointed in CM and stacking within 30M (only traps etc.) fit for subsequent reuse, **100mm bore of pipes.** | Each | 124 |
| 21-57 | Same as item 21-56, but **150 mm bore of pipes.** | Each | 186 |
| 21-58 | Same as item 21-56, but **230 mm bore of pipes.** | Each | 278 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Sludge Pumps** | | |
| 21-59 | **Pumping set, submersible,** Sewerage type, with AC electric motor 400V, 3phase, 50 cycles, capacity **14 cum / hour,** head 30ft/9.14M, supply and fixing. | Each | 228300 |
| 21-60 | Same as item 21-59, but discharge **15 cum/ hour,** head 60ft/18.30M. | Each | 422177 |
| **21N61** | Same as item 21N59, but discharge **16 cum/ hour,** head 100ft/30M. | Each | 767484 |
| 21-62 | Same as item 21-59 to 21-61, but fixing only. | Each | 1155 |
| 21·63 | Same as item 21-59 to 21-62, if removal only. | Each | 866 |

# SECTION-22

# PRE-ENGINEERED CONSTRUCTION

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-22

# PRE-ENGINEERED CONSTRUCTION

## SPECIFICATIONS

**22.0.** This section covers all operations for Pre-cast RCC slabs, Pre-stressed RCC girder, Pre-cast RCC planks and columns for boundary walls, Single or Double Tee, RCC roof panels and other pre-cast / prefabricated / pre-engineered structures.

## MATERIAL REQUIREMENTS

**22.1.** A number of pre-casting companies manufacture and market different kinds of pre-cast concrete products, which include the following:-

(1) **Pre-cast Concrete Conventional Roofing system** consisting of I-section girder and slabs.

(2) **Single/ Double Tee Slab Roofing system** with following spans.

(a) **Double Tee** 3.048 M x 0.712 M upto 21.336M

(b) **Double Tee** 1.524 **M x** 0.406 M upto 12.192M

(c) **Double Tee** 0.610 **M x** 0.133 M upto 6.096M

(3) **Pre cast Inverted and** "L" **Beam** for supporting Double Tee are commonly available in following sections:-

(a) **Inverted Tee Beam** - 305 x 699 mm/ 699 x 254 mm for 3.048 M wide Double Tee.

(b) **Inverted Tee Beam** - 305 x 406 mm/ 699 x 254 mm for 1.524 M wide Double Tee.

(c) L **Beam** - 305 x 686 mm/ 502 x 254 mm for 3.048 M wide Double Tee.

(d) L **Beam** - 305 x 406 mm / 502 x 254 mm for 1.524 M wide Double Tee.

(4) **Pre-cast Concrete Boundary Wall system** consisting of concrete H-Section column with in-fill planks, and I Section column with beam and in-fill masonry.

**22.2.** Items mentioned in Para 22.1 above must be manufactured by employing fully equipped plant using concrete design mix for strength of **41.38 MPa** (6000 psi) for girders, Double Tee, Inverted beams and "L" beams etc., whereas **34.48 MPa** (5000 psi) for slabs and planks etc.

**22.3. Reinforcement.** Reinforcement of high tensile carbon steel must conform to ASTM A-421.

**22.4. Conventional Roofing system**

22.4.1. The Girder and Slab system comprises of pre-stressed concrete, I-section girder or batten combining with RCC slab having ribs running in either direction. With the availability of a wide range of different standard girder and slab sizes, this system can be assembled with scores of assorted combinations of different girders/ slab sizes fulfilling the individual geometry and loading requirements of each work. This system is easy to handle without heavy hoisting equipment.

22.4.2. This Roofing system is used upto 21.336 M spans. Girders/Slabs can be placed on masonry bearing wall or on RCC beams. It can also be used in multi-storey buildings.

22. 4.3. RCC pre-stressed main and secondary girders must be produced on a long line extrusion process by pouring on a long bed at a stretch and then cut to pieces of required length with the help of special cutting equipment.

22.4.4. **Common Sizes of Pre-Cast Girders.** A large variety of pre-cast girders and beams is available in the market. AASHTO has specified specific sizes of Girders according to the spans. These are casted at site generally with 28 days cylindrical compressive strength of 6000 Psi. High strength seven strand tendons with ultimate Tensile strength 270 ksi are used for pre-stressing and post tensioning. Tendons may be bonded or un-bonded. Losses of pre-stressing must be clearly specified by the manufacturer but not greater than 15%. However, for the purpose of this Schedule, commonly used sizes of girders have been elaborated in Table 22-1 and Figure 22-1.

22.4.5. **Pre-cast Slabs.** These should be casted on a plant to achieve proper compaction by vibration system to give a uniform structure, of specified size with accurate dimensions and quality. 'The commonly available sizes considered for the purpose of this Schedule are highlighted in Table 22-2.

**TABLE 22-1**

**Commonly Available Sizes of Girders**

| Size | Weight (Kg / M) |
|---|---|
| 102 mm x 228 mm | 37.215 |
| 114 mm x 280 mm | 47.635 |
| 127 mm x 337 mm | 55.078 |
| 127 mm x 356 mm | 61.032 |
| 152 mm x 368 mm | 64.000 |
| 178 mm x 457 mm | 89.315 |
| 203 mm x 483 mm | 110.155 |
| 203 mm x 508 mm | 138.438 |
| 203 mm x 610 mm | 163.749 |
| 203 mm x 686 mm | 178.630 |
| 203 mm x 762 mm | 196.493 |

**TABLE 22-2**

**Commonly Available Sizes of Pre-cast Slabs**

| Size | Weight (Kg) |
|---|---|
| Length 0.914M to 1.397 Mand Width 0.457 M<br>1.397 **M x** 0.457 M | 48.50 |
| Length exc 1.397 M but not exc 1.981 M ,and Width 0.457 M<br>1.981**M x** 0.457 M | 79.10 |
| Length 0.914M to 1.397 M and Width 0.3048 M<br>1.397 **M x** 0.3048 **M** | 33.30 |
| Length 1.524M to 1.981 Mand Width 0.3048 M<br>1.981**M x** 0.3048 M | 55.80 |

**22.5. Single/ Double Tee Slab Roofing System**

22.5.1. This system is used as structural roofing from 3.353 M to 21.336 M span. It is made with high strength concrete produced on a plant in controlled conditions and using high tensile carbon steel. Double Tee slab roofing system offers strength, economy in cost, speed of erection and aesthetically pleasant appearance.

22.5.2. The system is used as a deck member in floor and roof of offices, workshops, storage go downs and parking structures.

22.5.3. The details about safe loads for various spans are shown in typical Figures 22-2 to 22-8.

**22.6 Hollow Core Slab.** In this system hollow core pre-stressed slabs are used, these are light weight and economical with high moment of area as compared to weight. The load carrying capacities are given in Table 22-3.

**22.7. Steel K-Span System.** It comprises of an arch type roof using pre-painted galvanized iron (PPGI) sheets (thickness from 0.5 mm to 1.3 mm). It can span 6.096 M to 32.004 M. The work shall be undertaken as per the manufacturer's instructions and rates given are guideline for preparation of project estimates. The commonly available steel K span pre-engineered structures for different widths (spans) considered for this Schedule are given in Table 22 - 4.

**22.8. Light Gauge System.** In this system, light gauge steel sheets are used which are cold rolled. The wall panels, roof trusses and floor joints are all made up of roll-formed, cold rolled steel sections of thickness ranging from 0.7 mm to 1.15 mm, complying with ASTM A 653 grade 340 and 550. This system is time saving, economical and may be used in small buildings.

**22.9 Pre-cast Boundary Wall System.** The details of the components of the system is as shown in Figure 22-9 to 22-11.

22.9.1. This system consists of following components:-

(1) RCC pre-cast pre-stressed Columns.

(2) RCC pre-cast pre-stressed plinth Beams.

(3) RCC pre-cast in-fill planks (Plain and Coloured).

22.9.2. Item will be casted as per Para 22.2 above.

22.9.3. Panels formed by erection of section columns at suitable distance and inter-linked with plinth beams may be filled with normal masonry work, instead of in-fill planks.

**TABLE 22-3**

**Load Carrying Capacities- Hollow Core Slab 4'(width) x 8"(Thickness)**

| | LOAD CARRYING CAPACITY OF VARIOUS SPANS (lbs/ ft) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Noof Strands -Dia** | **15 Feet** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| **5-3/8"** | 1168 | 1002 | 864 | 749 | 651 | 567 | 496 | 433 | 379 | | | | | | | |
| **6-3/8"** | | 1158 | 1002 | 872 | 761 | 667 | 586 | 516 | 454 | 401 | | | | | | |
| **7-3/8"** | | | 1140 | 994 | 871 | 766 | 676 | 598 | 529 | 470 | 417 | | | | | |
| **5-3/8" +2-1/2"** | | | | 1190 | 1047 | 925 | 820 | 729 | 649 | 580 | 518 | 464 | 415 | | | |
| **5-1/2"** | | | | 1239 | 1091 | 965 | 856 | 762 | 679 | 607 | 544 | 487 | 437 | | | |
| **6-1/2"** | | | | | 1288 | 1142 | 1017 | 909 | 814 | 731 | 657 | 592 | 534 | 482 | | |
| **6-1/2" +1-3/8"** | | | | | | 1241 | 1106 | 990 | 888 | 799 | 720 | 651 | 588 | 533 | 483 | |
| **7-1/2"** | | | | | | 1320 | 1178 | 1055 | 948 | 854 | 771 | 697 | 631 | 573 | 520 | 473 |

## CONSTRUCTION REQUIREMENTS

**22.10. Pre-Engineered Construction System** is highly specialized job. Therefore, it must be executed through experts equipped with suitable equipment and labour.

**22.11. Pre-cast / Pre-Engineered Structures**

22.11.1. Other types of pre-cast/ prefabricated concrete and steel structures are of different design and shapes for residential, storage, commercial, parking of vehicles and aircrafts etc. The design and execution is based on requirements and parameters, given by the user.

22.11.2. The work may be under taken as a complete job through recognized and approved firms. The design produced by the Firm be got vetted from DD &Coran approved Consultant, before execution.

22.11.3 **Prefab steel Construction with Built-up Sections.** This comprises of built up Rafters Column system with pre painted Alu zinc sheets along with Polyurethane or Rockwool insulation. Cold form purlins conforming to ASTM 572 are used to support roof sheets. Rafters are shop welded and field bolted. High strength galvanized bolts conforming to ASTM 325/ A490 standards are used for connections. Galvanized anchor bolts conforming to ASTM 307 standards are used to connect columns with the base plate and pedestals. All members are painted with rust proof paint.

22.11.4 **Light Gauge Steel Construction.** In this system, light gauge steel sheets are used which are cold rolled and in relatively thin sections. All members are painted with rust proof paint. Roof and wall panels are insulated with Poly Urethane (PU} panels or Rockwool. The wall panels, roof trusses and floor joints are all made up of roll-formed cold rolled steel sections of thickness ranging from 0.7 mm to 1.15 mm, complying with ASTM A 653 grade 340 and 550. The steel is hot dipped galvanized with minimum zinc coating, Z 275. Rate of this type of Construction depends on design, therefore, will be decided as per final design, manufacturer's specifications and drawings.

## METHOD OF MEASUREMENTS

**22.12.** All linear dimensions to be measured net.

**22.13. Roofs.** Measure all projections and pay at the same rates.

**22.14.** No deduction or addition shall be made on any account for:-

(1} Opening not exceeding 0.2 Sqm area.

(2) Joints (locking, rebated, tongued and grooved etc.}.

(3) Linear labour (small) and incidental labour.

## CLARIFICATION OF RATES

**22.15.** The rates inter alia, include particularly:-

(1) All matters specified which apply.

(2) Aggregates of any grade.

(3) Work in any position and of any thickness.

(4) Linear and incidental labour produced by form work, cores, etc., except where a separate item exits.

(5) Curing and protection.

(6) Hoisting up to 6 M above or below ground level for girder, slab, inverted / L beam and Double Tee etc.

(7) Hoisting upto 10 M above GL for Steel "K" Span.

(8) Transportation upto 250 km for girder, slab, inverted/ L- Beam and Double Tee etc.

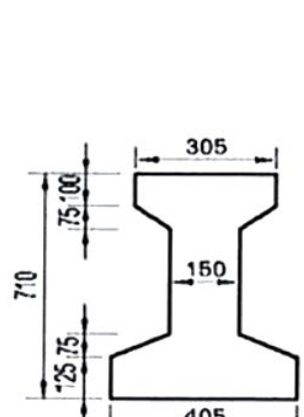
(9) Transportation upto 200 km for Steel "K" Span.

(10) All reinforcement forming part of pre-stressed, pre-cast items are included in the concrete supply and fixing rates.

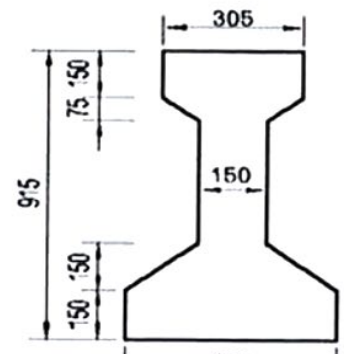
(11) Pre-stressed / pre-cast concrete items conforming to BSS-4482 and the requisite strength are only payable under this section.

(12) Any addition/ allied items of work are payable under relevant Schedule items.

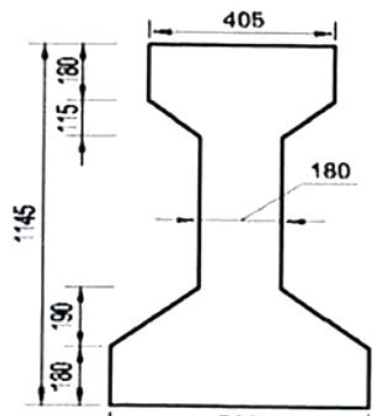
(13) Cement and Steel for pre-stressed/ pre-cast work shall not be issued under Schedule "B".



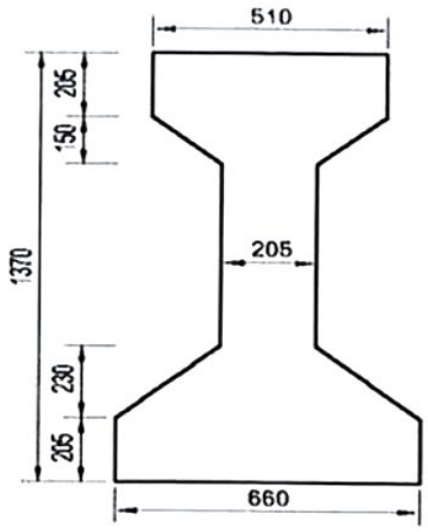

Type-I : 9 to 14 m span



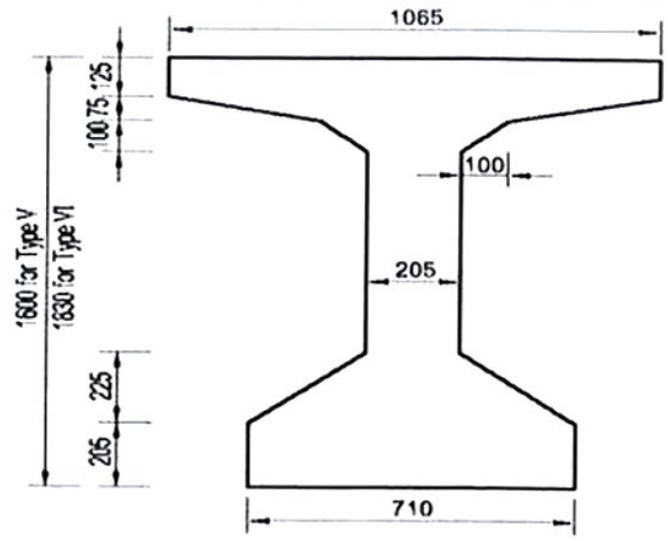

Type-II : 12 to 18 m span




Type-III : 17 to 24 m span




Type-IV : 21 to 30 m span




Type-V : 27 to 37 m span
Type-VI : 34 to 43 m span

STANDARD AASHTO GIRDERS

FIGURE 22-1: AASHTO GIRDER

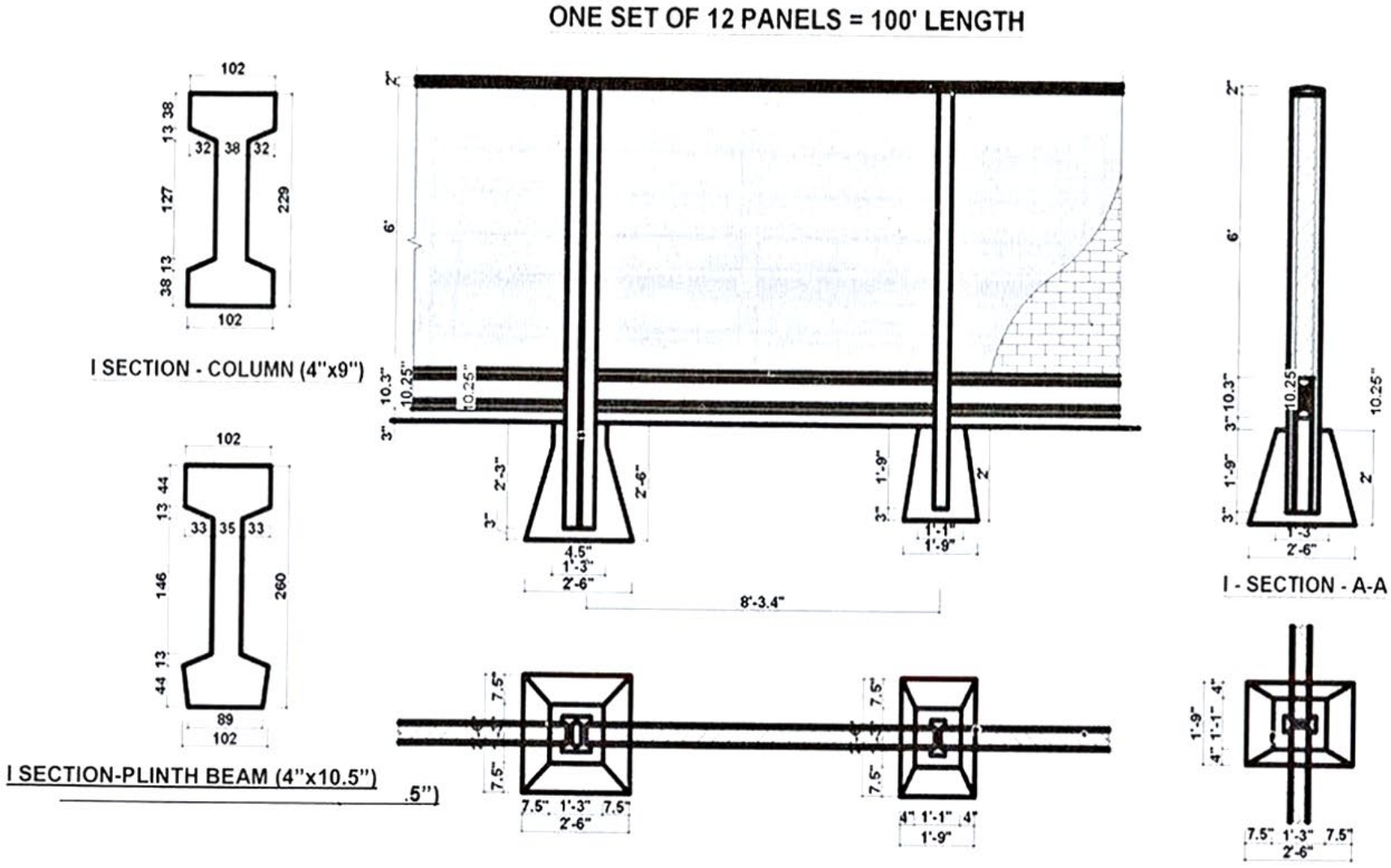



FIGURE: 22-2

PRECAST / PRESTRESSED BOUNDARY WALL (Masonry / Block Fill)

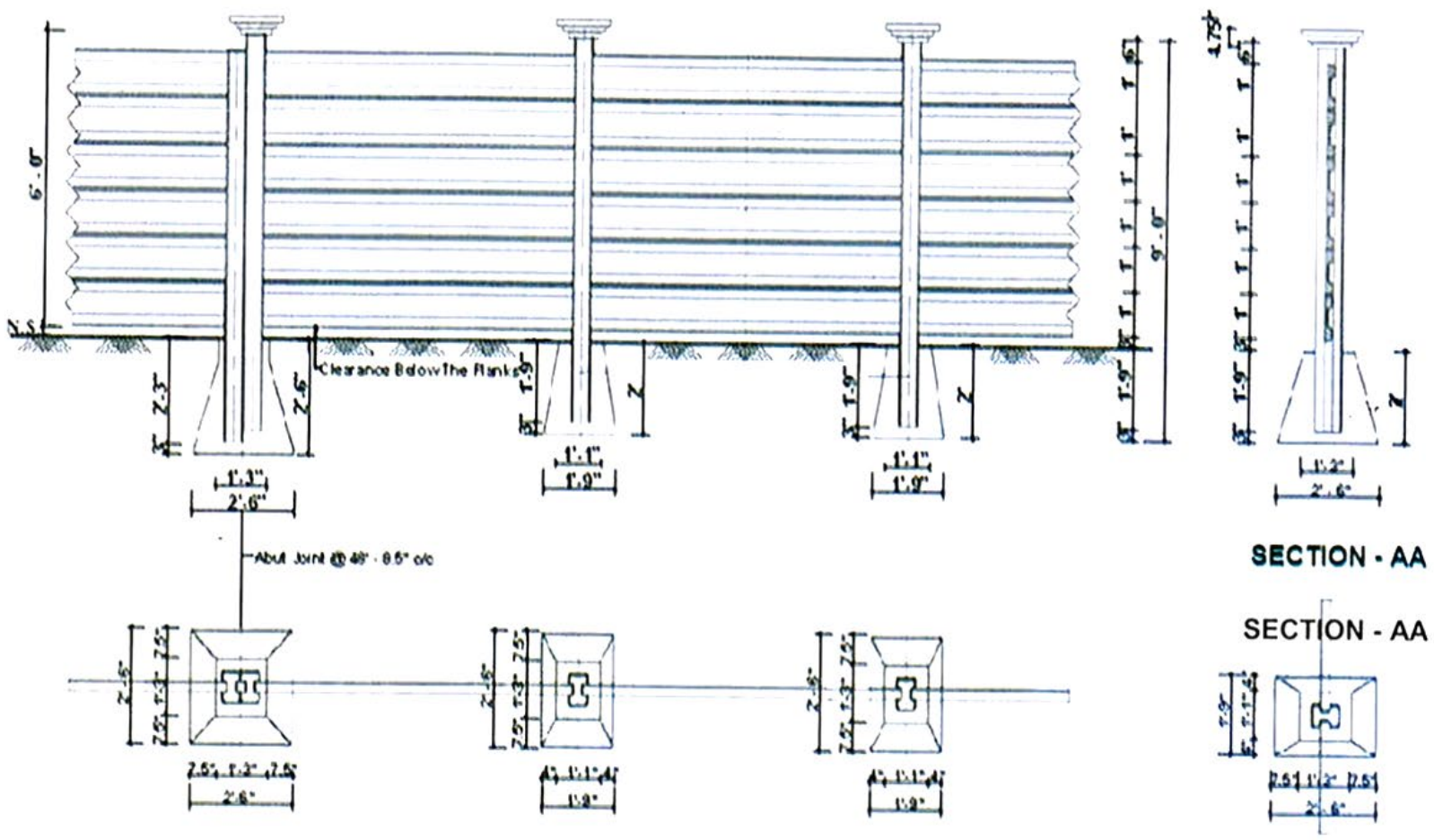



FIGURE: 22-3

PRECAST / PRESTRESSED BOUNDARY WALL (In Fill Panels)
(Without Coloured Strips)

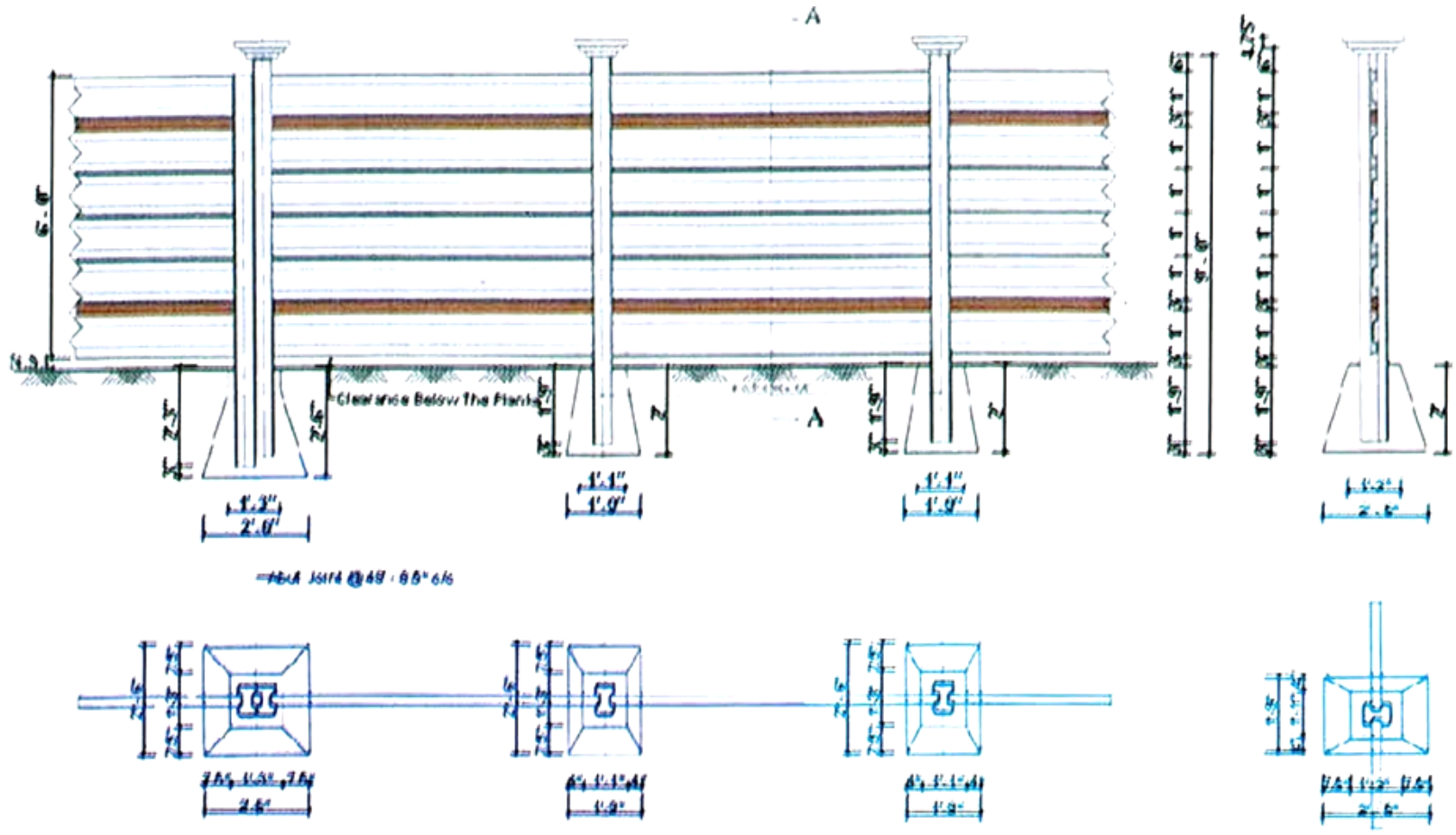
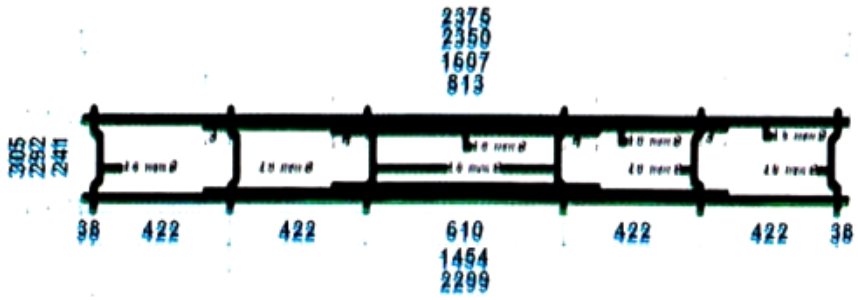



FIGURE: 22-4

SECTION - AA

PRECAST / PRESTRESSED BOUNDARY WALL (In Fill Panels)

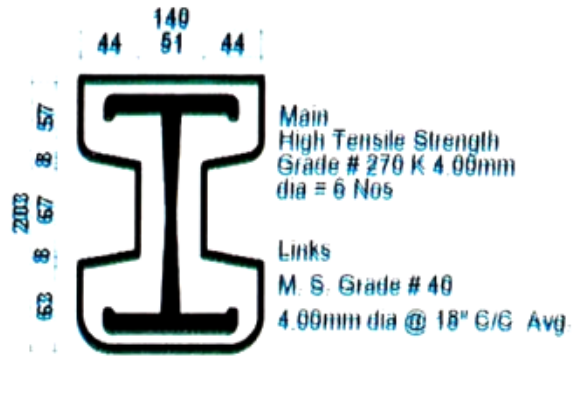
(With Two Coloured Strips)



Main (Nail Wire) 4.5mm dia 92.5" Long = 2 Nos
Extra (Nail Wire) 4 mm dia 63.25" Long = 2 Nos
Extra (Nail Wire) 4 mm dia 32" Long = 2 Nos
Distribution (Nail Wire) 4 mm dia 11.5" Long = 6 Nos

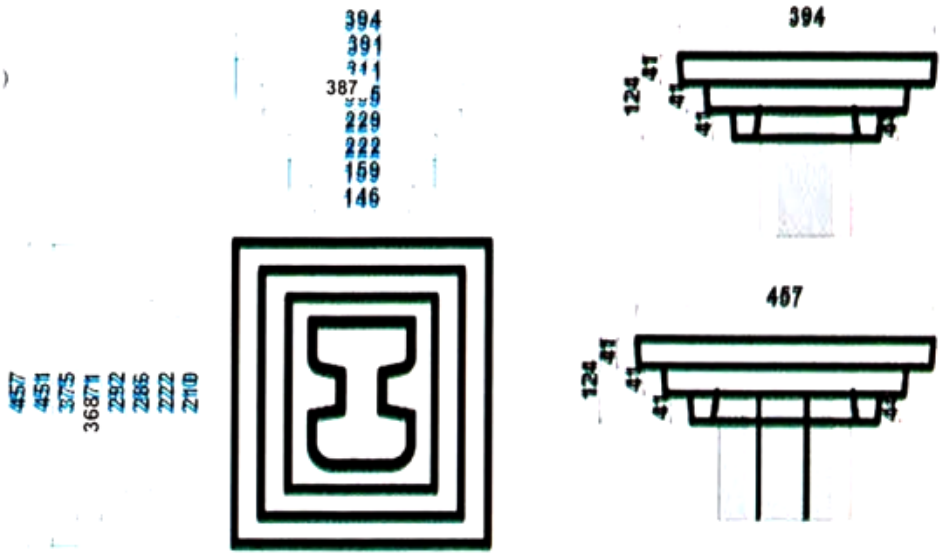
## Precast Boundary Wall Plank

( Concrete 5000 psi Cube Strength after 28 days )




## Precast Prestressed Boundary Wall Column

( Concrete 5000 psi Cube Strength after 28 days )




## Precast Boundary Wall Cap

( Concrete 5000 psi Cube Strength after 28 days )

FIGURE: 22-5

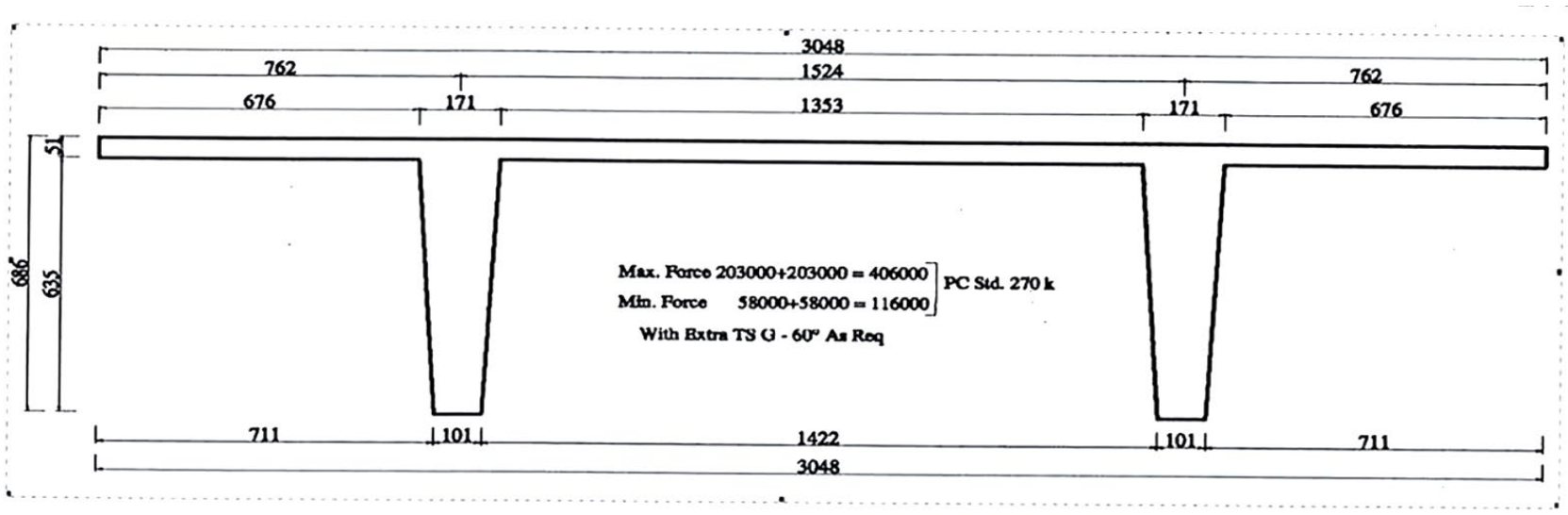



**FIGURE 22-6 : TYPICAL DOUBLE TEE**

**3.048x 0.686M, Self Weight = 259 Kg/ sqm**

**Safe Super Imposed Service Load Incl 97Kg/sqm L.L**

**(Kg/ Sqm)**

| 270 K STRAND PATTERN | FEET | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | 7.925 | 8.534 | 9.144 | 9.754 | 10.363 | 10.973 | 11.582 | 12.192 | 12.802 | 13.411 | 14.021 | 14.630 |
| ½"0,2+2 | | 741 | 601 | 487 | 394 | 317 | 253 | | | | | | |
| ½"0,3+3 | | | | 840 | 705 | 592 | 498 | 418 | 350 | 292 | 241 | | |
| ½"0,4+4 | | | | | | 851 | 729 | 626 | 537 | 461 | 396 | 338 | 288 |
| ½"0,5+5 | | | | | | | | 832 | 724 | 631 | 550 | 480 | 418 |
| ½"0,6+6 | | | | | | | | | | 791 | 695 | 612 | 540 |
| ½"0,7+7 | | | | | | | | | | | 840 | 746 | 662 |
| ½"0,7+ 7+Ts+¼"0 (1+1) | | | | | | | | | | | | 811 | 723 |
| ½"0,7+ 7+Ts+¼"0 (2+2) | | | | | | | | | | | | | 784 |
| ½"0, 7+ 7+Ts+¼"0 (3+3) | | | | | | | | | | | | | |

| 270 K STRAND PATTERN | FEET | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 | 70 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | 15.240 | 15.850 | 16.459 | 17.069 | 17.678 | 18.288 | 18.898 | 19.507 | 20.117 | 20.726 | 21.336 |
| ½"0,2+2 | | | | | | | | | | | | |
| ½"0,3+3 | | | | | | | | | | | | |
| ½"0,4+4 | | 243 | | | | | | | | | | |
| ½"0,5+5 | | 363 | 314 | 271 | 233 | | | | | | | |
| ½"0,6+6 | | 475 | 418 | 368 | 322 | 281 | 245 | | | | | |
| ½"0,7+7 | | 588 | 523 | 464 | 412 | 365 | 323 | 285 | 250 | | | |
| ½"0,7+ 7+Ts+¼"0 (1+1) | | 644 | 574 | 512 | 457 | 407 | 362 | 321 | 284 | 250 | | |
| ½"0,7+ 7+Ts+¼"0 (2+2) | | 701 | 627 | 561 | 502 | 449 | 401 | 358 | 329 | 283 | 250 | |
| ½"0, 7+7+Ts+¼"0 (3+3) | | 740 | 663 | 595 | 534 | 478 | 429 | 384 | 343 | 306 | 272 | 241 |

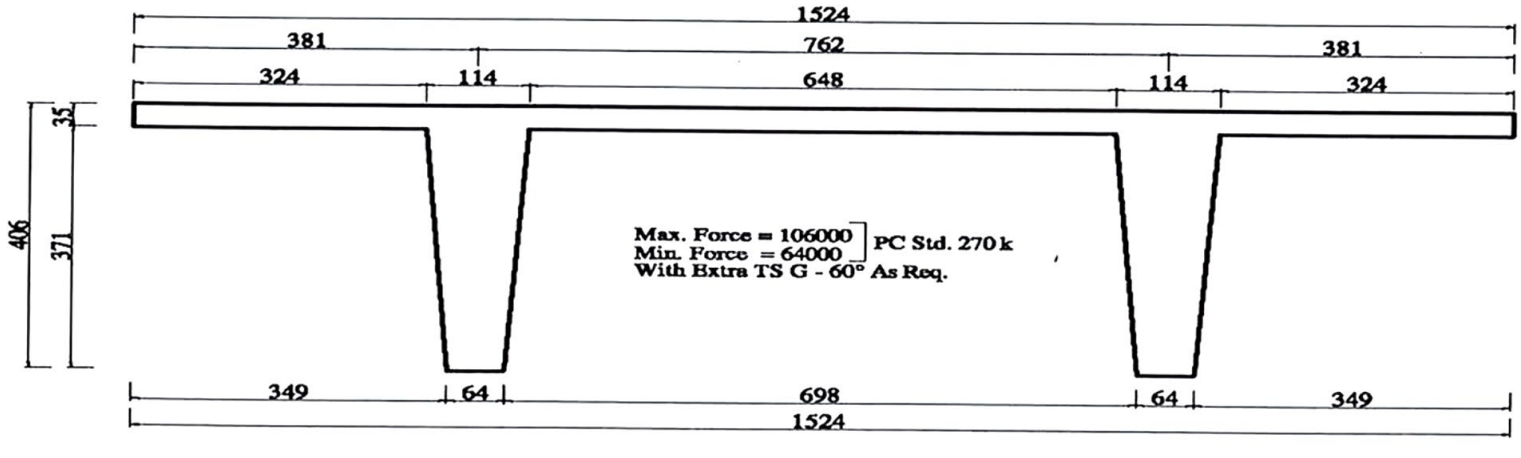



**FIGURE 22-6 TYPICAL DOUBLE TEE**

**1.524 x 0.406 M, Self Weight= 190 Kg/ sqm Safe**
**Super imposed Service Load incl 97Kg/sqm L.L**
**(Kg / Sqm)**

| 270 K STRAND PATTERN | FEET | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | 6.706 | 7.315 | 7.925 | 8.534 | 9.144 | 9.754 | 10.363 | 10.973 | 11.582 | 12.192 |
| ¾" 0, 2+2 | | 716 | 568 | 452 | 361 | 287 | | | | | |
| ¾"0, 3+ 3 | | | | 730 | 607 | 502 | 415 | 344 | 284 | | |
| ¾" 0, 3+3+Ts+½"0, 1+1.06 L | | | | | 717 | 597 | 499 | 418 | 350 | 293 | |
| ¾" 0, 3+3+Ts+½"0, 2+2.06 L | | | | | | 693 | 583 | 492 | 416 | 352 | 297 |

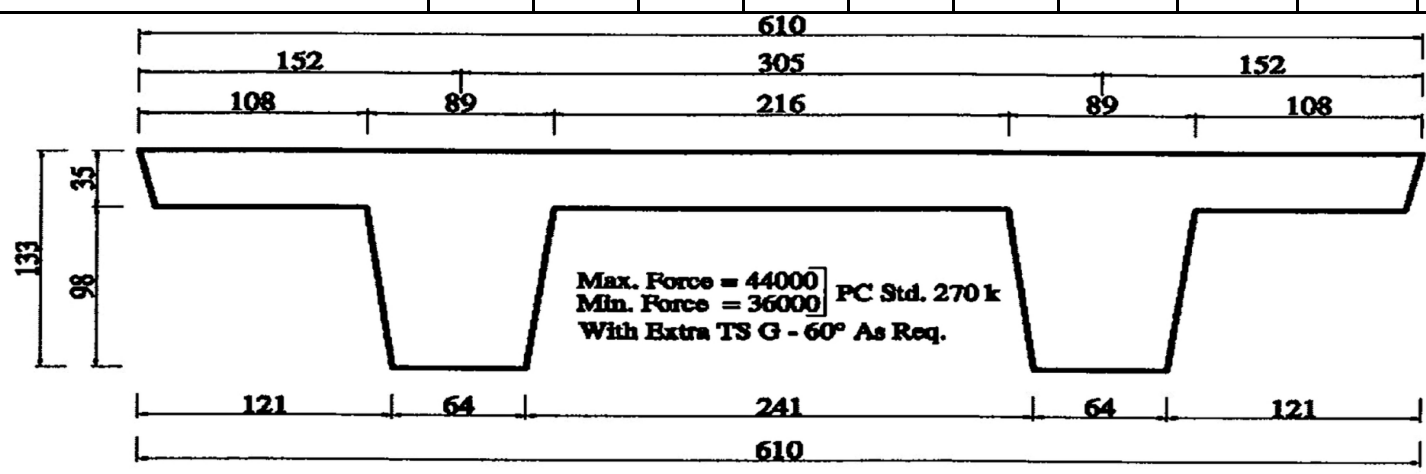



FIGURE 22-7 TYPICAL DOUBLE TEE
0.610 x 0.133 M, Self Weight= 147 Kg/ sqm
**Safe Super imposed Service Load** incl **97Kg/sqm** L.L
**(Kg/ Sqm}**

| 270 K STRAND PATTERN | FEET | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | 3.353 | 3.658 | 3.962 | 4.267 | 4.572 | 4.877 | 5.182 | 5.486 | 5.701 | 6.096 |
| 5 mm 0, 3+3 | | 780 | 693 | 517 | 425 | 351 | 283 | | | | |
| ¾" 0, 1+1, 3.5 mm 0 1+1 | | | 712 | 581 | 478 | 395 | 327 | 273 | | | |
| ¾" 0, 1+1, 4 mm 0 1+1 | | | 752 | 615 | 508 | 420 | 356 | 293 | 244 | | |
| ¾" 0, 1+1, 5 mm 0 1+1 | | | | 683 | 566 | 468 | 395 | 332 | 278 | | |
| ¾" 0, 1+1, 5 mm 0 1+1+ Ts ¾ 0, 1+1, 0.5 L | | | | | 702 | 591 | 503 | 425 | 361 | 308 | 261 |

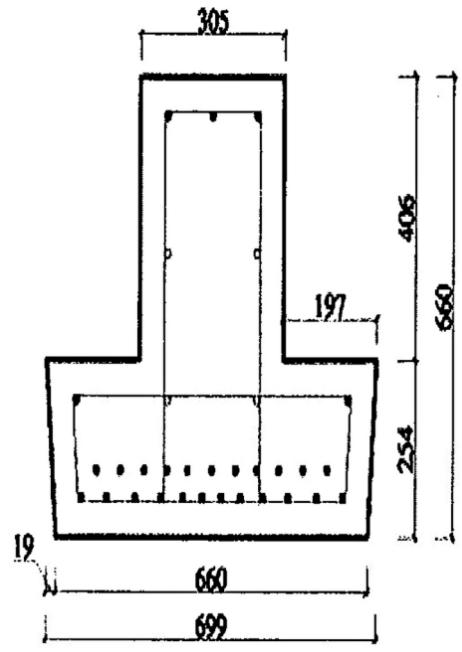



**FIGURE 22-8 : TYPICAL INVERTED TEE BEAM**
**305 X 406 / 699 X 254 FOR 1.524 DOUBLE TEE 0.406**

Self Weight= 480 lbs/Rft, 218 Kg/ Rft
Safe Super imposed Service Load
(Kg/ Sqm}

| 270 K STRAND PATTERN | FEET | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | 3.658 | 4.267 | 4.877 | 5.486 | 6.096 | 6.706 | 7.315 | 7.925 | 8.534 |
| ½"0 4 Nos | | 9960 | 7126 | 5287 | 4026 | | | | | |
| ½"0 6 Nos | | | 11050 | 8291 | 6399 | 5046 | 4045 | | | |
| ½"0 8 Nos | | | | 11295 | 8773 | 6969 | 5634 | 4619 | | |
| ½"0 10 Nos | | | | | 11147 | 8892 | 7223 | 5954 | 4967 | |
| ½"0 12 Nos | | | | | | 10815 | 8812 | 7290 | 6104 | 5886 |
| ½"0 14 Nos | | | | | | | 10402 | 8625 | 7442 | 6145 |
| ½"0 16 Nos | | | | | | | | 9960 | 8380 | 7126 |
| ½"0 18 Nos | | | | | | | | 11295 | 9518 | 8107 |
| ½"0 20Nos | | | | | | | | | 10655 | 9088 |

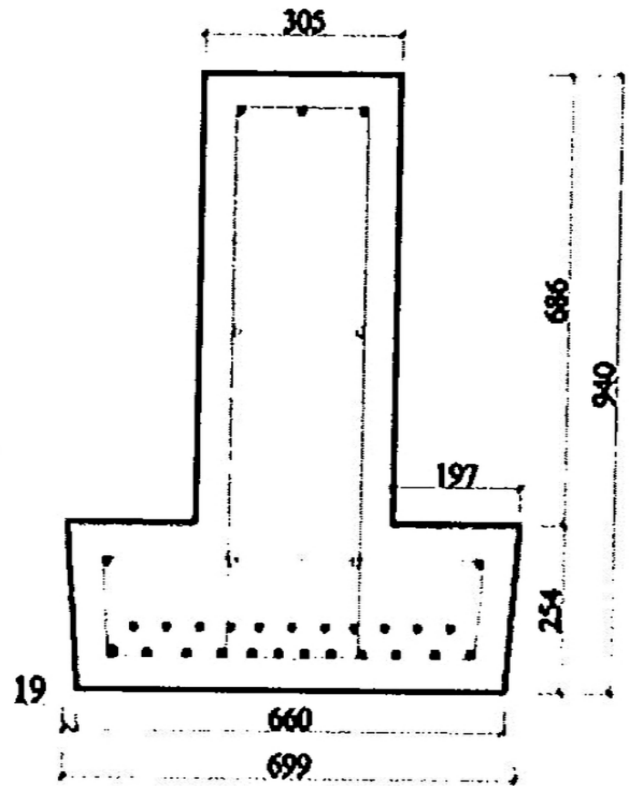



**FIGURE 22-9** : **TYPICAL INVERTED** TEE **BEAM**
**305 X 686 / 699 X 254 FOR 3.048 DOUBLE** TEE **0.686**
**Self Weight = 617 lbs/Rft , 280 Kg/ Rft**
**Safe Super** imposed **Service Load**
**(Kg/ Sqm}**

| 270 K STRAND PATTERN | FEET | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | 3.658 | 4.267 | 4.877 | 5.486 | 6.096 | 6.706 | 7.315 | 7.925 | 8.534 |
| ½"0 4 Nos | | 15139 | 10879 | 8114 | 6218 | | | | | |
| ½"0 6 Nos | | | 16651 | 12533 | 9710 | 7690 | 6196 | | | |
| ½"0 8 Nos | | | | 16952 | 13202 | 10519 | 8534 | 7024 | | |
| ½"0 10 Nos | | | | | 16952 | 13347 | 10871 | 8988 | 7523 | |
| ½"0 12 Nos | | | | | | 16176 | 13209 | 10952 | 9196 | 7803 |
| ½"0 14 Nos | | | | | | | 15546 | 12917 | 10870 | 9246 |
| ½"0 16 Nos | | | | | | | | 14881 | 12543 | 10689 |
| ½"0 18 Nos | | | | | | | | | 14217 | 12132 |
| ½"0 20 Nos | | | | | | | | | | 13575 |

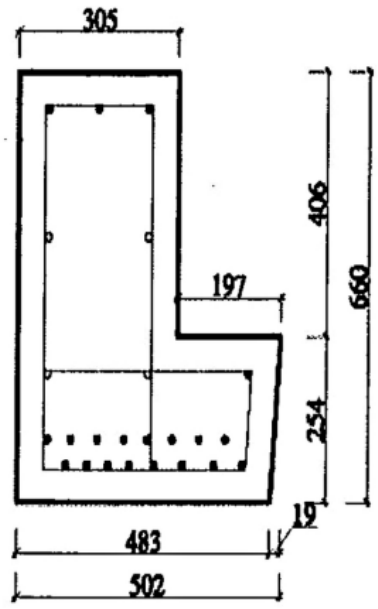



**FIGURE 22-10: TYPICAL L - BEAM**
**305 X 406 / 502 X 254 FOR 1.524 DOUBLE TEE 0.406**
**Self Weight = 402 lbs/Rft , 182 Kg/**
**Rft Safe Super imposed Service**
**Load (Kg / Sqm)**

| 270 K | FEET | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|
| STRAND PATTERN | M | 3.658 | 4.267 | 4.877 | 5.486 | 6.096 | 6.706 | 7.315 | 7.925 | 8.534 |
| ½ "0 4 Nos | | 9739 | 6996 | 5216 | 3996 | 3123 | | | | |
| ½"0 6 Nos | | | | 8124 | 6293 | 4984 | 4015 | 3278 | | |
| ½"0 8 Nos | | | | | 8590 | 6845 | 5553 | 4570 | 3806 | 3100 |
| ½"0 10 Nos | | | | | | 8705 | 7091 | 5863 | 4907 | 4148 |
| ½"0 12 Nos | | | | | | | 8628 | 7154 | 6008 | 5098 |
| ½"0 14 Nos | | | | | | | | 8447 | 7109 | 6047 |
| ½"0 16 Nos | | | | | | | | | 8210 | 6996 |

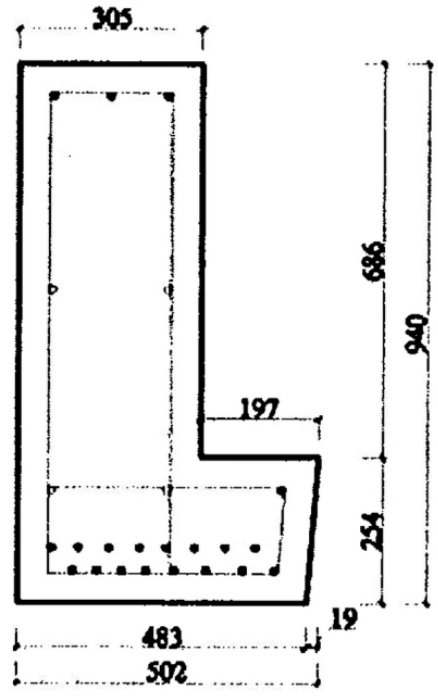


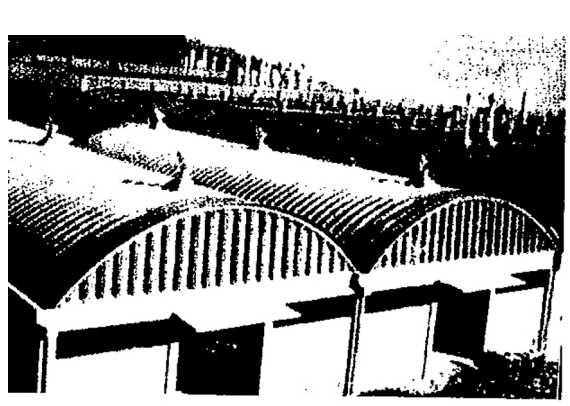

**FIGURE 22-11 : TYPICAL L - BEAM**
**305 X 686 / 502 X 254 FOR 3.048 DOUBLE TEE 0.686**
**Self Weight= 518 lbs/Rft, 235 Kg/ Rft**
**Safe Super imposed Service Load**
**(Kg/ Sqm)**

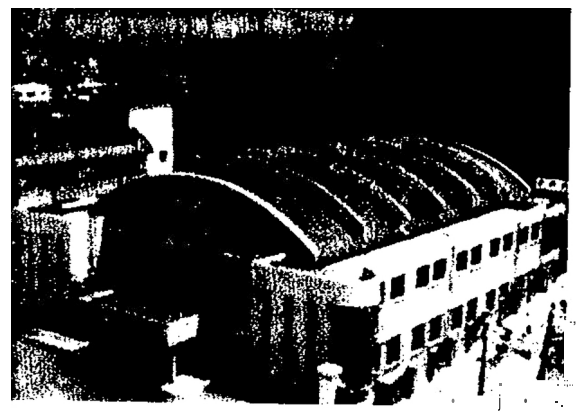
| 270 K | FEET | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|
| STRAND PATTERN | M | 3.658 | 4.267 | 4.877 | 5.486 | 6.096 | 6.706 | 7.315 | 7.925 | 8.534 |
| ½ "0 4 Nos | | 14703 | 10588 | 7189 | 6088 | 5582 | | | | |
| ½"0 6Nos | | | 16284 | 12280 | 9534 | 7570 | 6116 | 5011 | | |
| ½"0 8 Nos | | | | 16640 | 12979 | 10361 | 8423 | 6949 | 5802 | 4903 |
| ½"0 10 Nos | | | | | 16425 | 13152 | 10730 | 8888 | 7454 | 6316 |

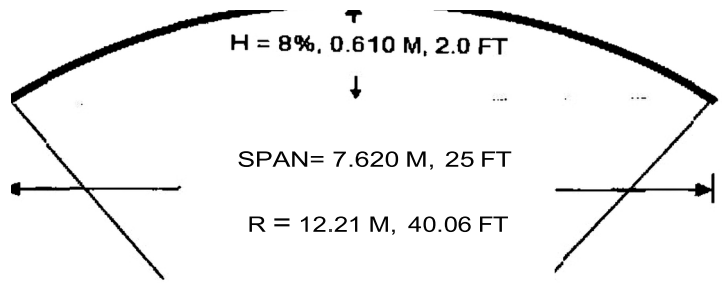
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ½"0 12 Nos | | | | | 15943 | 13036 | 10826 | 9105 | 7740 |
| ½"0 14 Nos | | | | | | 15343 | 12746 | 10757 | 9164 |
| ½"0 16 Nos | | | | | | | 15047 | 12702 | 10842 |

## TABLE 22-4

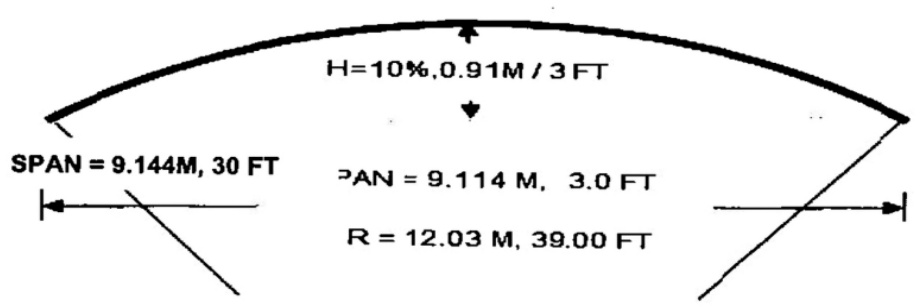
**TYPICAL STEEL K SPAN** - (6.096 M to 32.004 M Spans)



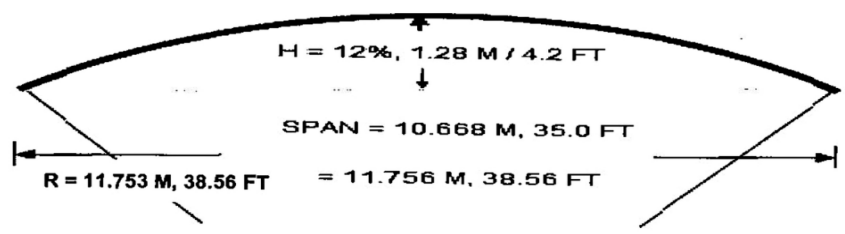




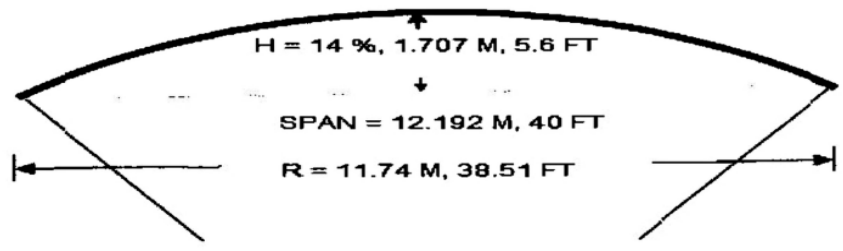

| SNo | THICNESS OF SHEET (PPGI) mm | SPAN RANGE | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 1 | 0.5 | 6.096 - 7.620 | 20-25 | 7.620 | 25 | 8 | 0.610 | 2 |



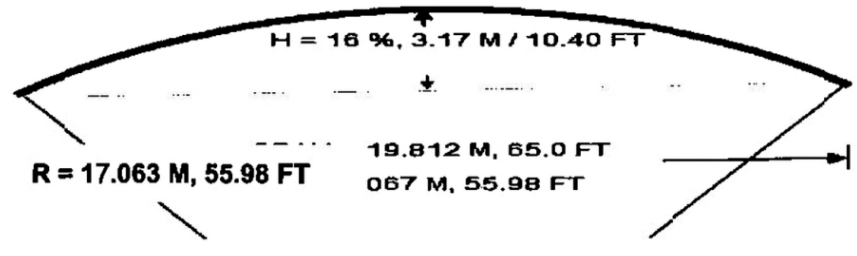

| S No - | THICNESS OF SHEET (PPGI) mm | SPAN RANGE | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 2 | 0.6 | 7.925 - 9.144 | 26-30 | 9.144 | 30 | 10 | 0.914 | 3 |



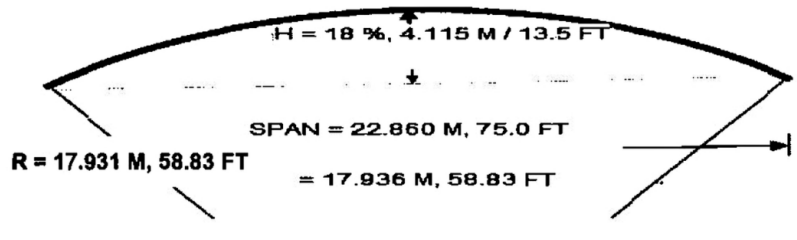

| S No | THICNESS OF SHEET (PPGI) mm | SPAN RANGE | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | , M | FEET | % | M | FEET |
| 3 | 0.7 | 9.449 - 10.668 | 31-35 | 10.668 | 35 | 12 | 1.280 | 4.20 |



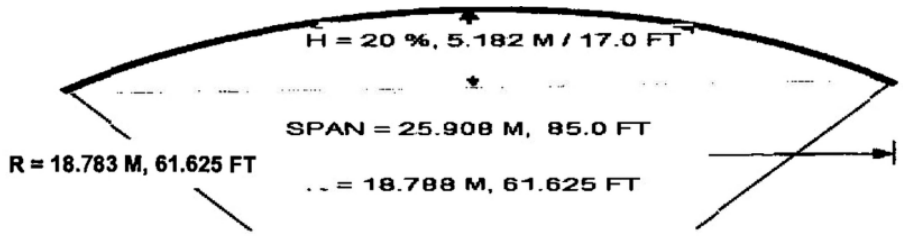

| S No | THICNESS OF SHEET (PPGI) mm | SPAN RANGE | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 4 | 0.8 | 10.973-12.192 | 36-40 | 12.192 | 40 | 14 | 1.707 | 5.60 |



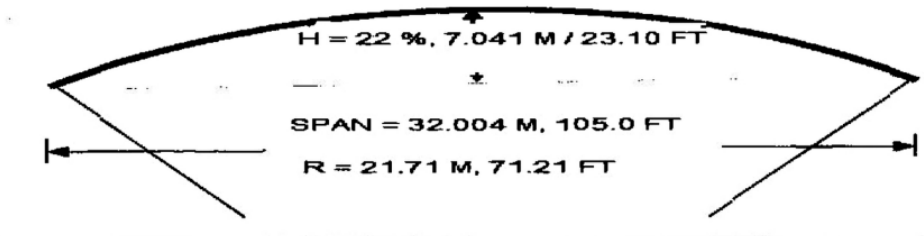

| SNo | OF SHEET (PPGI) mm | | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 5 | 0.9 | 12.497-19.812 | 41-65 | 19.812 | 65 | 16 | 3.170 | 10.40 |




| SNo | THICNESS OF SHEET (PPGI) mm | | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 6 | 1.00 | 20.117 - 22.860 | 66-75 | 22.860 | 75 | 18 | 4.115 | 13.50 |




| S No | THICNESS OF SHEET (PPGI) mm | SPAN RANGE | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 7 | 1.20 | 22.860-25.908 | 75 - 85 | 25.908 | 85 | 20 | 5.182 | 17.00 |




| S No | THICNESS OF SHEET (PPGI) mm | SPAN RANGE | | TAKE SPAN | | HEIGHT | | |
|---|---|---|---|---|---|---|---|---|
| | | M | FEET | M | FEET | % | M | FEET |
| 8 | 1.30 | 26.213 – 32.004 | 86 - 105 | 32.004 | 105 | 22 | 7.041 | 23.10 |

ITEM RATES

| Sl No. | Description | Unit | Rates (Rs) |
|---|---|---|---|
| | Slabs | | |
| 22-1 | Providing and laying, Pre-cast, RCC slab, length 0.914 M to 1.398 M and width 0.457 M, including hoisting, setting and jointing in CM (1:4), all as specified. | Sqm | 1828 |
| 22-2 | Same as item 22-1, but length exceeding 1.398 Mand not exceeding 1.981 M, width 0.457 M. | Sqm | 2296 |
| 22-3 | Same as item 22-1, but length 0.914 M to 1.398 M, width 0.304 M. | Sqm | 1885 |
| 22-4 | Same as item 22-1, but **length 1.524 M to 1.981 M, width 0.304 M.** | Sqm | 2486 |
| | **Girders** | | |
| 22-5 | Providing and laying, **Pre-cast pre-stressed, R.C.C girders size 102 mm x 228 mm,** including setting and hoisting, all as specified for **span 2.438 M to 4.877 M.** | Metre | 1304 |
| 22-6 | Same as item 22-5, but size **114 x 280 mm (for span 5.182 M to 6.172 M).** | Metre | 1886 |
| 22-7 | Same as item 22-5, but **size 127 x 337 mm (for span 5.182 M to 6.782 M).** | Metre | 2231 |
| 22-8 | Same as item 22-5, but **size 127 x 356 mm (for span 5.486 M to7.391 M).** | Metre | 2423 |
| 22-9 | Same as item 22-5, but **size 152 x 368 mm (for span 6.096 M to 8.306 M).** | Metre | 2519 |
| 22-10 | Same as item 22-5, but **size 178 x 457mm (for span 7.315 M to 10.058 M).** | Metre | 3720 |
| 22-11 | Same as item 22-5, but **size 203 x 483 mm (for span 8.534 M to11.278 M).** | Metre | 4252 |
| 22-12 | Same as item 22-5, but **size 203 x 508 mm (for span 9.754 M to 12.69 M).** | Metre | 5408 |
| 22-13 | Same as item 22-5, but **size 203 x 610 mm (for span 5.182 M to 9.449 M).** | Metre | 5908 |
| 22-14 | Same as item 22-5 but **size 203 x 686 mm (for span 5.486 M to 10.973 M).** | Metre | 6738 |
| 22-15 | Same as item 22-5 but **size 203 x 762 mm (for span 5.791 M to 11.582 M).** | Metre | 7314 |
| | **Double Tees** | | |
| 22-16 | Providing and laying, **precast pre-stressed, RCC, Double Tee,** size 3.048 M x 0.712 M, RCC roof panel (having web size 101mm x 171mm and slab thickness 51mm), for **span from 9.754 M to 12.802 M** including hoisting, complete, all as specified. | Sqm | 5236 |
| 22-17 | Same as item 22-16, but for span from **13.410 M to 15.240 M.** | Sqm | 5586 |
| 22-18 | Same as item 22-16, but for span from **15.850 M to 17.678 M.** | Sqm | 5984 |
| 22-19 | Same as item 22-16, but for span from **18.288 M to 18.898 M.** | Sqm | 7006 |
| 22-20 | Same as item 22-16 but for span from **19.507 M to 21.336 M.** | Sqm | 6637 |
| 22-21 | Providing and laying, **pre-cast pre-stressed, RCC, Double Tee,** size 1.524 M x 0.406 M, RCC roof panel (having web size 64mm x114mm and slab thickness 35 mm) span from 6.096 M to 7.925 M, including hoisting, complete, all as specified. | Sqm | 5152 |
| 22-22 | Same as item 22-21, but for **span from 8.534 M to 9.754 M.** | Sqm | 5152 |
| 22-23 | Same as item 22-21 but for **span from 10.363 M to 10.973 M.** | Sqm | 5293 |
| 22-24 | Same as item 22-21 but for **span from 11.582 M to 12.192 M.** | Sqm | 5433 |
| | **Inverted Tee Beams** | | |
| 22-25 | Providing and laying, **pre-cast pre-stressed, RCC, Inverted Tee beam,** size 0.305 M x 0.699 M x 0.254. For Double Tee, size 1.524 M x 0.406 M, for **span from 3.658 M to 6.096 M,** including hoisting, complete, all as specified. | Metre | 19167 |
| 22-26 | Same as item 22-25, but for **span from 6.401 M to 8.534 M.** | Metre | 19448 |
| 22-27 | Providing and laying, **pre-cast pre-stressed, RCC, Inverted Tee bea .** size 0.305 M x 0.406 M x 0.254 M. For Double Tee size, 1.524 M x 0.406 M, for **span from 3.658 M to 6.096 M,** including hoisting, complete, all as specified. | Metre | 18254 |
| 22-28 | Same as item *22-27,* but for **span from 6.401M to 8.534M.** | Metre | 18815 |
| | **'L' Beams** | | |
| 22-29 | Providing and laying, **pre-cast pre-stressed, RCC,** L **beam,** size 0.305 M x 0.686 M x 0.254M. For Double Tee, size 3.048 M x 0.686M, for **span from** | Metre | 17332 |

| Sl No. | Description | Unit | Rates (Rs)l |
|---|---|---|---|
| | **3.658 M to 6.096 M**, including hoisting, complete, all as specified. | | |
| 22-30 | Same as item 22-29, but for span from 6.401 M to 8.534 M. | Metre | 17613 |
| 22-31 | Providing and laying, pre-cast, pre-stressed, RCC, 'L' beam size 0.305 M x 0.406 M x 0.254 M. For Double Tee, size 1.524 M x 0.406 M, for span from 3.658 M to 6.096 M, including hoisting, complete, all as specified. | Metre | 15829 |
| 22-32 | Same as item 22-31, but for **span from 6.401 M to 8.534 M.** | Metre | 16110 |
| | **Boundary Wall** | | |
| 22-33 | Providing and laying, **pre-cast pre-stressed, RCC, "H" Section boundary wall,** column size 102 mm x 229 mm, length 2.438 M to 3.658 M, complete, all as specified. | Metre | 828 |
| 22-34 | Same as item 22-33 but , **column size 140 mm x 203 mm.** | Metre | 1462 |
| 22-35 | Providing and laying, **pre-cast RCC boundary wall,** coloured strip, 76 mm wide and 64 mm thick, all as specified. | Metre | 420 |
| 22-36 | Providing and laying, **RCC pre-cast boundary wall column caps,** all as specified. | Each | 472 |
| | **Steel 'K'-Span** | | |
| 22-37 | Supply and fix, **Pre-Painted Galvanized Iron (PPGI) steel sheets** for Steel 'K - **Span from 6.096 M to 7.620 M using 0.5 mm, thick sheet** @ 4.166 kg/sqm, complete, all as specified. | Sqm | 1603 |
| 22-38 | Same as item 22-37, but for **span from 7.925 M to 9.144 M, using 0.6 mm thick sheet** @ 4.941 kg/sqm | Sqm | 1887 |
| 22-39 | Same as item 22-37, but for **span from 9.449 M to 10.668 M, using 0.7 mm** thick sheet@ 5.705 kg/sqm. | Sqm | 2148 |
| 22-40 | Same as item 22-37, but for span from 10.973 M to 12.192 M using 0.8 mm **thick sheet@** 6.480 kg/sqm. | Sqm | 2416 |
| 22-41 | Same as item 22-37, but for **span from 12.497 M to 19.812 M, using 0.9 mm thick sheet@** 7.244kg/sqm. | Sqm | 2675 |
| 22-42 | Same as item 22-37, but for **span from 20.117 M to 22.860 M, using 1.00 mm thick sheet@** 8.019kg/sqm. | Sqm | 2952 |
| 22-43 | Same as item 22-37, but for **span from 22.860M to 25.908 M, using 1.2 mm thick sheet** @ 9.548kg/sqm. | Sqm | 3457 |
| 22-44 | Same as item no. 22-37, but for **span from 26.213 M to 32.004 Musing 1.3 mm thick sheet** @ 10.323kg /sqm | Sqm | 3701 |
| 22-45 | Add to item 22-01 to 22-32, for hoisting for each subsequent 4M or part thereof. | Kg | 4 |
| 22-46 | Add to item 22-37 to 22-44, for hoisting for each subsequent 4M or part thereof. | Kg | 44 |
| 22-47 | Add to item 22-37 to 24-44, for transportation, for each subsequent 100 km or part thereof. | Kg | 44 |
| 22-48 | Providing and erecting **Precast Hollow core slab** size 1.292 M x 0.2 M for **span 5.79 M to 6.4 M** including hoisting, setting and jointing in CM (1:4) all as specified. | Sqm | 4976 |
| 22-49 | Same as item 22-48 but for **span 7.01 M to 8.23 M.** | Sqm | 6258 |
| 22-50 | Same as item 22-48 but for **size 1.2192 M x 0.265 M for span 7.01 M to 8.23 M,** all as specified. | Sqm | 5675 |
| 22-51 | Same as item 22-50 but for **span 8053 M to 9.75 M.** | Sqm | 6661 |
| 22-52 | Supply and fixing, fabrication and errection of LGS structure upto required height and floor area as per user requirements/ manufactures specifications, (Rate will be decided after design/ specifications). | Sqm | |

# SECTION-23

# DEMOLITION **AND DISMANTLING**

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | Al/THORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-23

# DEMOLITION AND DISMANTLING

## SPECIFICATIONS

**23.0.** The work covered under this section consists of providing all materials, labour, equipment and performing all operations for demolition/ dismantling, concrete, asphalt, walls, foundation, roof, floor, iron / steel and wood work etc.

**23.1.** When there are rates, else-where in the Schedule for **"add if in repairs",** the demolition or dismantling rates described in this section will NOT be applicable either in addition to or in substitution of**"add if in repair"** items.

**23.2. Demolition.** Implies taking down or breaking up, removing as ordered, spreading and leaving as required will normally be applied to (ACI 546R, Table 2.1) :-

23.2.1. Ordinary concrete cast in situ, RCC, brickwork and stone masonry.

23.2.2. Asphalt work.

**23.3. Dismantling.** Implies carefully taking up or down without damage (either large or small quantities), in patches or for work in repairs or replacements of parts where not otherwise provided for in the schedule and carting to store (if directed by Engineer-in-Charge) any useful materials, sorting, stacking, cleaning and the removal of all nails, screws and bolts from timber and disposal of rubbish *off* the site and will normally be applied to all other classes of work.

**23.4. Damage.** To any part of the work which is to be left intact, will be made good by the Contractor at his expense.

**23.5. Cutting Opening through Walls**

23.5.1. For doors, windows and other purpose not covered below include forming reveals and rough face work, except provision of arches, lintels and new finishing around opening which will be paid for separately under the relevant items.

23.5.2. For small holes for pipes etc., where surface area does not exceeding 900 Sq Cm, including all work like filling, finishing and making good.

**23.6. New Works in Making Good.** After dismantling etc will be paid for under the respective items in other sections of the Schedule. No additional payment for connecting up to existing work etc. be made.

**23.7. Cutting Through** or excavating and grubbing up concrete, brickwork etc., in floors, road, paving and foundations will be paid under the items for "Excavation and Earth works" in Section-1, as applicable.

## METHOD OF MEASUREMENTS

**23.8. Measurements of all Work** shall be made before dismantling and as described for new work in respect of deductions for voids, opening etc. and no allowance be made for any increase in bulk.

**23.9. Measurements for Brickwork.** Plaster on one or both sides are to be exclusive of plaster thickness, but the rates for demolition including taking down the plaster.

**23.10. In cutting for Openings.** Measurements will be net finished size of the new opening or enlarged portion of opening.

**23.11. No Addi!ional Allowance.** Will be made for cutting and pinning in bolts, holdfasts, ends of steps, timbers, etc.

## CLARIFICATION OF RATES

**23.12.** The rates, inter alia, include particularly:-

(1) Use and waste of all temporary strutting and shoring required, and clearing away after use, together with any scaffolding, tools, plants, watching etc.

(2) Removal of all serviceable materials to store, or fresh site within the contract area, if so required.

(3) Removal of all unserviceable materials on Ministry of Defence premises with in a distance of 4 Km and spreading, leveling, stacking, etc. as directed.

(4) As an alternative to Para 23.12.3 above, removal of all unserviceable materials from Ministry of Defence premises, in which case the materials shall become the property of the Contractor and no deduction shall be made for their value.

# ITEM RATES

| Sl No | Description | Unit | Rate {Rs.) |
|---|---|---|---|
| | **Concrete** | | |
| 23-1 | Demolition of **Plain Cement Concrete.** | Cum | 2174 |
| 23-2 | Demolition of **Premix Carpet / Bituminous Pavements.** | Cum | 2254 |
| 23-3 | Add to item 23-1 and 23-2, if dismantled in portions. | Cum | 225 |
| 23-4 | Demolition of **RCC floor or beams / roof slabs etc., separating reinforcement from concrete,** cleaning and straightening the same. | Cum | 2429 |
| 23-5 | Same as item 23-4 but **when reinforcement is not required to be separated from concrete.** | Cum | 2254 |
| | **Walls, Foundations** | | |
| 23-6 | Demolition of **walls, built in brick work, or Concrete blocks, or in stone masonry,** built in any CM, including **pillars, lintels, struts etc.** | Cum | 957 |
| 23-7 | Add to item 23-6, if dismantled in portions. | Cum | 225 |
| | **Mud on Roofs** | | |
| 23-8 | Removing **mud from roofs, including plastering and leaping,** if any. | Cum | 226 |
| 23-9 | Take up, **Stone or Pre-cast concrete slab, floors,** of any thickness, laid in any mortar. | Cum | 882 |
| 23-1**O** | Add to item 23-9, if dismantled in portions. | Cum | 38 |
| | **Cutting Openings** | | |
| 23-11 | Cutting through walls etc, for doors, windows or other opening, or enlarging existing openings and form reveals, as specified, in burnt brick work, Stone masonry or Concrete block laid in any mortar. | Cum | 3312 |
| 23-12 | Same as item 23-11, but **RCC,** including cutting reinforcement. | Cum | 4278 |
| 23-13 | **Cutting small openings, for pipes** etc., where surface area does not exceeding 900 sq cm, and make good around the same, **in Burnt brick work, Stone masonry or Concrete blocks in any mortar.** | Cum | 2326 |
| 23-14 | Same as item 23-13, but **in RCC including cutting reinforcement.** | Cum | 4430 |
| | **Wood Work** | | |
| 23-15 | Cut out and demolish **timber in scantling,** in any position, not elsewhere provided for, clear out nails etc., remove and stack at site. | Cum | 2640 |
| 23-16 | Cut out and demolish **timber boarding,** including flooring or other position, not elsewhere provided, and stack on site | Sqm | 79 |
| 23-17 | Cut out and demolish **ballies,** any dia. | Metre | 26 |
| | **Iron and Steel Work** | | |
| 23-18 | Take down **CI, Iron or AC** flue (or smoke) pipes, eaves, gutters, rain water pipes, valley gutters or flashing ridges and hips including bends, swan necks, shoes etc., and any supports or brackets, there to, (gutters, flashing ridges and hips to be measured in this item only when not taken down as part of roofing). | Metre | 83 |
| 23-19 | Dismantle **Steel or Iron work** of any description, and in any position, not elsewhere provided for. | Kg | 14 |
| 23-20 | Any position, not elsewhere provided for, dismantle to remove, **iron or steel sheeting** in hearths covering to doors, frames, curbs, mangers and similar fittings any description or gauge. | Sqm | 50 |
| | **Roof** | | |
| 23-21 | Dismantle, **AC corrugated sheets or corrugated iron plain sheeting** to walls, ceilings etc., including any ridges, hips, valleys, wind ties, barge and eaves boarding (net area of roof and or walls measured). | Sqm | 54 |

| Sl No | Description | Unit | Rate {Rs.) |
|---|---|---|---|
| | **Miscellaneous** | | |
| 23-22 | Dismantling **single tiling of brick or PCC in roof or floor,** laid in CM, including half bricks or blocks on edge, in any portion. | Sqm | 120 |
| 23-23 | Same as item 23-22, but of any other description including ridges, hips or valleys (net area of roof surface measured, no additional allowance for ridges, hips and valleys). | Sqm | 180 |
| 23-24 | Dismantle **double tiling of brick or PCC in roof** laid in CM, including half bricks or blocks on edge, in any position. | Sqm | 216 |
| 23-25 | Same as item 23-24, but of any other description, including ridges, hips and valleys (net surface of roof area measured). | Sqm | 324 |
| | **Finishing** | | |
| 23-26 | Taking up or down, **tiles/ Marble/ granite work** of any type laid in floors / walls etc. | Sqm | 180 |
| | **Plumbing and Drains** | | |
| 23-27 | Take down sheet lead in flats, gutters, dormers, flashing, ridges, hips cisterns, etc. and similar work (not to be paid when gutters, ridges and hips are taken down as part of roofing). | Kg | 4 |

# SECTION - 24

# INTERNAL ELECTRIFICATION

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | Al/THORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION -24
# INTERNAL ELECTRIFICATION

## SPECIFICATIONS

**24.0. Electrical Standard Requirement etc.** All electrical works shall be carried out in accordance with the Electricity Regulations Govt of Pakistan and Pakistan Standard Specifications for Electrical equipment of buildings, here-in after referred to as "Rules", except where these rules are modified by these specifications.

### 24.1. Materials

24.1.1. Except where otherwise specified, all materials shall be supplied, fixed, connected and completed by the contractor.

24.1.2. All materials shall comply with the relevant and latest BS or equivalent Pakistan Standard Specifications.

24.1.3. **Fittings and Accessories.** All fittings / accessories shall conform to current BS or its equivalent Pakistan Standard Specifications. No inferior quality material is allowed for use in works.

24.1.4. **Cables and Cords.** All cables and cords shall be of CMA grade or equivalent Pakistan grade, approved by the Engineer-in-Chief from time to time.

24.1.5. **Size of Conductor.** The min size of conductor shall be:-

(1) Lighting cables with copper conductor of 1 $mm^2$ /1.5 $mm^2$ sectional area.

(2) Lighting flexible cord, copper conductor of 0.75 $mm^2$ sectional area.

(3) Power cable with copper conductor of 2.5 $mm^2$ sectional area.

(4) Sub-main cables with copper conductors of 4 $mm^2$ sectional area.

(5) Any other size of copper conductor when required, shall comply with Electricity Regulations, Govt. of Pakistan.

24.1.6. **Socket Outlet Points (3 Pin, 5 Amps and 15 Amps)**

24.1.6.1. The 3rd conductor, i.e. Earth shall be 14 SWG solid bare copper conductors (soft), or 1 $mm^2$ or 1.5 $mm^2$ PVC insulated copper cable and shall be electrically continuous throughout the installation.

24.1.6.2. Socket outlets shall be of shutter pattern.

**24.2. Building Work.** The position of all holes or cutting away will be agreed with Engineer-in-Charge before the work is under taken. All making good shall match the existing surroundings.

### 24.3. Siting of Electrical Equipment

24.3.1. The siting of cable/conduit runs, controls, fittings/accessories etc, must be in accordance with plans and settled on site in conjunction with the Engineer-in-Charge before commencement of work

24.3.2. The height from the floor level to bottom of fittings shall be as follows:-

| | | |
|---|---|---|
| (1) | Main Control | 1.75 M |
| (2) | Distribution Board | 1.75 M |
| (3) | Pendant and interior bracket | 2.50 M |
| (4) | Socket outlets (generally) | 230mm |

24.3.3. The siting of main switches, meter and distribution board for officer's bungalow and important buildings shall be done in the rear/side veranda or in any suitable place in rear of the building.

### 24.4. Mounting of Fittings and Accessories

24.4.1. Ordinary pendant and similar lighting fittings and accessories shall be mounted direct in / on conduit box etc.

24.4.2. Distribution board and the like shall be secured by means of coach screws, rag bolts or other suitable method as approved by the Engineer-in-Charge.

24.4.3. Spacer bar saddle shall be secured by 25 mm long screws.

### 24.5. Conduit Wiring

24.5.1. The system shall consist of single core PVC un-sheathed cables in screwed steel / PVC conduits installed for surface or concealed wiring as specified.

24.5.2. The loop-in system shall be employed, where necessary or advisable, teeing off by means of taped porcelain connectors in conduit boxes, may be utilized as approved by Engineer-in-Charge.

## 24.6. Conduit and Conduit fittings

24.6.1. All other conduits shall be of Heavy gauge Class "B" welded seam as per BSS 31, given in Table 24-1.

**TABLE 24-1**

**Standard Dimensions & Weights of Steel Conduits**

| Outside dia | 20mm | 25mm | 40mm | 50mm |
|---|---|---|---|---|
| Threads per 25 mm | 16 | 16 | 14 | 14 |
| Max length of threads on ends | 14mm | 17mm | 20mm | 23mm |
| Nominal thickness | 1.83 mm | 1.83 mm | 2.03mm | 2.34 mm |
| Min thickness | 1.68 mm | 1.68 mm | 2.00 mm | 2.20 mm |
| Weight per metre before enamelling/ galvanizing | 0.79 Kg | 1.08 Kg | 1.85 Kg | 2.86 Kg |

*Note:- Conduit for magazines, explosive stores and POL installations shall be solid drawn.*

14.6.2. The conduit boxes and covers shall be of malleable Cl and shall conform to latest specifications. Solid fittings will not be permitted. Inspection elbows, tees or bends will be used for surface wiring at the ends of conduit immediately behind fittings or accessories, where specifically approved.

24.6.3. Fixing screws for conduit and inspection covers shall be of brass or rust proof material.

24.6.4. **Erection**

24.6.4.1. All conduit fittings shall be erected before any cables are drawn in. The number of cables allowed, in the conduit shall be as per table 24-2 or in accordance with Electricity Regulations, Govt. of Pakistan. All screwed connections shall be metal to metal and exposed screw thread and parts. Where the galvanizing or enamelling has been damaged, it shall be thoroughly cleaned and painted with two coats of anti-corrosive paint, done as the work proceeds.

24.6.4.2. All points shall be such as to ensure perfect electrical continuity and where running joints are necessary, Lock nuts shall be utilized.

24.6.4.3. Where conduit passes through principals, rafters, purlins or joists, whether of wood, iron or steel, these must be drilled in approved position to take the conduits, the holes being of the smallest possible dia, consistent with requirements.

24.6.4.4. Where the conduit passes through a floor, wall partition or ceiling, the hole shall be made good with cement or similar incombustible materials to the full thickness of the floor, wall, partition or ceiling and space through which fire might spread shall not be left. Junction between conduit and adoptable boxes, back outlet boxes and the like, not provided with entry spouts, also between conduit and Iron Clad (IC) distribution boards and control gear, shall be effected by means of lock nuts and conduit couplers into which will be screwed to a brass hexagonal smooth bore bush, from the inside of box or case. In addition to ensure perfect continuity, where boxes or cases have clearance holes, a brass compression washer shall be fitted between the bush and box or case. Conduit system shall be erected as far as possible to avoid traps where water may accumulate from condensation. Where this is unavoidable, suitable provision for drainage shall be made. Conduit shall be kept at least 150 mm clear and preferably below steam or water pipes.

24.6.5. **Bonding and Earthing.** All conduit systems shall be electrically continuous throughout the installation. The max conductivity resistance of the conduit and earthing lead shall not exceed one ohm (1D). All conduit systems shall be efficiently earthed.

## 24.7. Surface Conduit Wiring

24.7.1. No conduit shall be less than 20 mm dia

24.7.2. Normally the conduit shall be carried on the surface of walls and ceilings, but where conditions permit, the conduit may be run within hollow spaces of wall, floor, partition and ceiling or in roof spaces. Diagonal run will not be permitted for surface wiring and particular attention shall be paid to "sets", which must fit as close to the walls, as possible. The conduit shall be secured by means of spacer bar saddles made of Cl pressure steel fixed at iotervals of max 900 mm with a saddle plate 3 mm thick for conduits upto 40 mm dia and 5 mm for larger size of conduit. Where conduit is attached to iron or steel joisU pillar, suitable clips, spaced at 900 mm interval shall be utilized.

## 24.8. Concealed Conduit Wiring

24.8.1. No conduit shall be less than 20 mm dia. Normally the conduit shall be sunk in wall and ceiling to such depth that there is not less than 20 mm cover but where the construction of the building is such that it is found impossible or inadvisable to sink the conduit, then it shall be installed as surface wiring, with the approval of the

Engineer-in-Charge. The conduit shall be secured by means of hooks or other means fixed at intervals of 1.25 Mor within 100 mm of each fitting or accessory. Not more than four bends shall be provided in a single run of conduit.

24.8.2. Where a concealed conduit is to traverse on RCC roofs, it shall be embedded in concrete and not run on surface of the slabs.

24.8.3. Where junction boxes are fixed in walls etc, for drawing-in, the cover must fit flush with the plaster at all points.

24.8.4. Where junction boxes are laid under or in concrete or floors, traps of approved design having a flanged outer frame for keying into the concrete etc, and fitted with a recessed cover suitable for filling in with the floor material shall be utilized.

24.8.5. Where junction boxes are laid under wooden floors, properly constructed traps shall be put in the flooring and secured with suitable counter sunk brass screws.

24.8.6. Number of traps in the floors must be kept to a min.

24.8.7. Where flush type switches or socket outlets are specified, the plate must over-lap the cavity and fit flush with plaster at all points. No 'filling" or packing will be permitted.

24.8.8. Conduit buried in plaster, in ordinary circumstances, deemed not to be in a damp situation.

## 24.9. Flame Proof Conduit Wiring

24.9.1. The system shall consist of single PVC unsheathed cable in screwed steel conduit installed for surface wiring as specified.

24.9.2. The loop-in system shall be employed, where necessary or advisable, teeing off by means of taped porcelain in sheathed connectors in conduit boxes may be utilized as approved by the Engineer-in-Charge.

24.9.3. Capacities of different sizes of steel/ PVC conduits, in terms of cables are given in Table 24-2 and Table 24-3.

**TABLE 24-2**

**Max Capacity of Conduit**

| **Sizes of Cable** mm (in) | **Size of conduit** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 20 mm dia | | **25 mm dia** | | 40 mm dia | | 50 mm dia | |
| | **PVC** | **Steel** | **PVC** | **Steel** | **PVC** | **Steel** | **PVC** | **Steel** |
| 1 $mm^2$ | 12 | 12 | 20 | 19 | 41 | 39 | - | - |
| 1.5 $mm^2$ | 11 | 10 | 18 | 17 | 32 | 30 | - | - |
| 2.5 $mm^2$ (1/1.78) | 8 | 8 | 14 | 13 | 23 | 21 | 42 | 40 |
| 2.5 $mm^2$ (7/0.67) | 7 | 7 | 12 | 11 | 20 | 19 | 38 | 36 |
| 4$mm^2$ | 5 | 5 | 9 | 9 | 17 | 16 | 30 | 28 |
| 6$mm^2$ | 4 | 4 | 7 | 7 | 11 | 10 | 19 | 18 |
| 10 $mm^2$ | 2 | 2 | 4 | 4 | 9 | 8 | 17 | 16 |
| 16$mm^2$ | 2 | 2 | 3 | 3 | 7 | 6 | 13 | 12 |
| 25$mm^2$ | - | - | 2 | 2 | 4 | 3 | 7 | 6 |
| 35$mm^2$ | - | - | - | - | 3 | 3 | 6 | 5 |
| 70$mm^2$ | - | - | - | - | 2 | 2 | 4 | 3 |

**TABLE 24-3**

**PVC Conduit for** Electric **wiring**

| **Nominal Size (mm)** | **Mean outside dla metre** | | **Wall Thickness** (mm) | **Weight** (kg/ m) |
|---|---|---|---|---|
| | **Minimum,** (mm) | **Maximum** (mm) | | |
| 20 | 21.2 | 21.5 | 1.09 | 0.098 |
| 25 | 26.6 | 26.9 | 1.16 | .0133 |
| 32 | 33.4 | 33.7 | 1.44 | 0.207 |
| 40 | 42.1 | 42.7 | 1.60 | 0.292 |
| 50 | 60.2 | 60.5 | 1.70 | 0.447 |
| 65 | 89.7 | 89.1 | 1.80 | 0.680 |
| 80 | 114.1 | 114.5 | 1.90 | 0.940 |

24.9.4. All conduits shall be Class "B", screwed, solid drawn and heavy gauge in accordance with BS 31 or equivalent Pakistan Standard specification.

24.9.4.1. **For Storage of Explosive Group-15.** The fittings shall be flame proof duly tested/ approved by Govt of Pakistan, Central Testing Laboratories Lahore, in accordance with BSS-31 & 229 or equivalent Pakistan Standard specification.

24.9.4.2. **For Storage of Explosive Groups-1, 2 & 4.** The fittings shall be dust proof in accordance with BSS-5490 or equivalent Pakistan Standard specification.

24.9.4.3. **For Storage of Remaining Explosive etc.** The fittings shall be totally enclosed in accordance with BSS-2817 or equivalent Pakistan Standard specification.

24.9.5. Fixing screws for conduit boxes and inspection covers shall be 8 mm x 14 mm. Tri head steel screws may be used or as specified by the Engineer-in-Charge.

**24.10. Point Wiring**

24.10.1. The wiring for a point shall be necessary for every room, passage, staircase, veranda, out building irrespective of the circuit.

24.10.2. The wiring shall be connected to any point on the existing wiring or to distribution board as ordered by the Engineer-in-Charge.

**24.11. External Wiring.** Where it is essential to take wiring under the ground it will be done by means of PVC cables of proper size laid underground and carried through appropriate size of GI pipe or conduit, laid in a cement lined duct, having sufficient gradient to draw off the water which may accumulate due to rains or other causes. The depth of the duct shall be decided by the Engineer-in-Charge. In cases where the wiring has to be taken to a building situated over 1.8 M from the main building, the cable shall be weather proof and attached to a galvanized steel suspension wire of suitable gauge able to carry the weight of the cable and in any case shall not be less than No.8 SWG. The attachment of the suspension wire shall be done by means of brass/ iron brass tinned clips of appropriate size as approved by the Engineer-in-Charge.

**24.12. Main Control.** When the voltage of a supply exceeds 250 volts and supply is given to different pairs of terminals, the terminals shall be arranged in such a manner that there shall be no danger of shock and the wiring from those terminals shall be kept distinct and apart. The siting of all controls shall be decided by Engineer-in-Charge.

**24.13. Earthed (Neutral) Conductor**

24.13.1. In all cases, where the supply conductors include an earth neutral, an indication of a permanent nature shall be provided to enable such neutral conductor to be distinguished from any live conductor, at the point.

24.13.2. The contractor shall similarly indicate the outgoing conductors. No fuse should be fixed, in an earthed neutral.

**24.14. Precautions vis-a-vis Gas, Water Supply etc, Fittings.** In bath rooms, lavatories, sculleries, kitchens or any place where gas, water taps/ fittings or masses of metal connected to earth are handled, special precautions shall be taken so that it is impossible to touch the electrical apparatus/fittings or the accessories and the gas or water system, etc, simultaneously.

**24.15.• Portable Appliances.** All portable fittings or appliances where the metal case may become alive, shall have the body earthed by means of a third conductor in the flexible cord. The armouring of any flexible cord shall also be efficiently connected to earth.

**24.16. Earthing.** *(These specifications will not apply to lightning conductors, which is covered in Para 24.19.)*

24.16.1. All metal parts other than conductors of electrical apparatus shall be efficiently earthed.

24.16.2. Where switches with earthed dollies are used, contractor shall ensure that the earthing links are in sound condition after fixing. The path to earth from any portion of a conduit system or other metal intended to be earthed shall be as direct as possible. The number of earthing connections for all equipments/ appliances/ fittings of medium and high voltage shall be as decided by Engineer-in Charge, but generally not less than two. Earthing conductors shall be of hard drawn bare copper or phosphor bronze as specified by Engineer-in-Charge of not less than No 8 SWG or its equivalent for cable upto 20 $mm^2$ and the connections shall be clearly visible and where necessary shall be protected from mechanical injury. Size of earthing conductor for cable higher than 20 $mm^2$, shall be in accordance with Table 24-4. No earth connection shall be made to hot water, steam or gas pipes. All connections to cold water pipe shall only be made, if they have metal-to-metal joints throughout and the water supply is in continuous use and in direct contact with the general mass of earth.

TABLE 24-4

| Load Cable size | Earthing lead (copper conductor) |
|---|---|
| 25 $mm^2$ to 35 $mm^2$ | 6SWG |
| 50 $mm^2$ to 95 $mm^2$ | 2SWG |
| 120 $mm^2$ and above | 3 /0 SWG |

24.16.3. Earth continuity conductors shall be taken to a common Earthing point outside the building. In case, where earth continuity conductors are connected together, they shall be connected through lugs and tinned and the outgoing conductors to the common earth point shall be at least twice the nominal area of the largest single earth continuity conductor installed.

24.16.4. The maximum continuity resistance from any point in the installation including the earth continuity conductor and earth lead to the earth pipe shall not exceed one ohm (10).

24.16.5. The earth shall be laid as below:-

(1) The excavation for the earth pipe shall be sunk to a depth of not less than 1.8 M for ordinary earth and 2.5 M for lightning conductors and shall not be less than 1.8 M from the nearest foundation.

(2) The pipe shall be perforated having 18 holes of 3 mm dia. and shall not be less than 25 mm dia. and 1.8 M in length in any case. The perforated holes shall be equally spaced as far as practicable.

(3) The pipe shall be erected vertically and shall be surrounded with 50 Kg coke breeze at the bottom and 50 Kg of Rock salt over the coke breeze to cover all sides. Resistance of the earth pipe with respect to the mass of earth shall not exceed 4 n and upto 10 n for **lightning conductors** is recommended.

(4) The earth wire from main earthing point to earth pipe shall be of hard drawn bare copper or phosphor bronze wire of not less than 8 SWG, or its equivalent and shall be buried not less than 50 mm below floor level of verandas when crossing the same. All channelling necessary shall be made good in all respects with appropriate materials.

(5) The shortest route to earth pipe shall be adopted but sharp bends and joints shall in all cases be avoided.

(6) The wire shall be connected through thimble placed in between two brass nuts and two brass washers on the top of 25 mm pipe.

(7) A cap shall also be provided on top of the pipe.

**24.17. Electric Meter.** Where meters are erected they shall be mounted on meter boards or as otherwise directed, in such manner that the spindles of the revolving elements are vertical, and the planes through the armatures and disc horizontal. They shall be connected in the positive wire in DC and in the phase wire in AC in all "earthed" system. Normally the height of the dial of meter shall be 1.7 M from floor.

**24.18. Switch Connections.** All single pole switches shall be installed in the uneanhed conductor that is the phase wire on AC and the positive wire on DC system.

**24.19. Lightning Conductors.** The entire work shall be carried out in accordance with the specifications given in the British Standard Code of Practice CP 326-101 or equivalent Pakistan standard specification with amendments there to, read in conjunction with TI No.47, as amended from time to time. All materials shall conform to the latest and relevant British Standard Specifications or equivalent Pakistan standard specification and as described in TI No.47. All metallic finials on or above the surface of the roof of the structure should be bonded to form part of the Air Termination net work

24.19.1. **Air Termination.** An air termination should be of copper hard or medium drawn, 15 mm dia, 1.5 M long, fixed with copper/gun metal base by means of brass bolts, nut and washer etc, and screwed properly. An air termination shall be interconnected by means of roof conductors/ ring conductors. Subsequently, the entire air termination network shall be finally connected to earth termination through down conductors.

24.19.2. **Roof Conductors.** All roof conductors shall be of copper strip, soft annealed 25 mm x 3 mm and shall be secured to roof by means of copper holdfasts and brass screws etc, and should be interconnected to air termination

24.19.3. **Down Conductors.** Down conductors should follow the nearest possible direct route between the air termination and the earth termination. There should be no upturn in any down coNductor and radius of any bend should be as large as possible. Each down conductor shall have to be provided with test joint at 0.3 M height from the GL in such a position that the testing is carried out conveniently.

24.19.4. **Ring Conductors.** Copper strip soft annealed 25 mm x 3 mm shall be used and secured properly with copper holdfasts and brass screws etc. The ring conductors shall be fixed 0.3 M above GL and bonded to magazine doors, window frame and electric conduits.

24.19.5. **Earth Termination.** The Earth termination of copper strip soft annealed 25 mm x 3 mm shall be fixed to Earth electrode either of:-

(1) GI pipe 25 mm dia perforated by means of bolts, nuts and washers etc, and soldering properly ensuring that no leakage to earth resistance is possible. **OR**

(2) 15 mm dia. copper rod by means of brass nuts and washers as shown in the drawing. The other end of the copper strip shall be connected to test joint.

24.19.6. **Earth Electrodes shall be of:-**

(1) 15 mm dia copper rod not less than 2.5 M length and shall be driven in the ground vertically.

(2) GI pipe 25 mm dia light quality as per SSS 1387 having 24 holes of 3 mm dia and not less than 2.5 M length shall be erected vertically and shall be surrounded with 50 Kg Coke Breeze at the bottom and 50Kg of Rock Salt over the Coke Breeze to cover all sides. Resistance of the earth pipe with respect to the mass of Earth shall not exceed 10 ohms (including air termination, down conductor, earth termination etc). Length of Earth electrode shall be increased to suit soil conditions, where it is necessary to bring the resistance within the limits.

24.19.7. **Joint and Bonds.** The joints and bonds should be kept to minimum as far as possible and all joints or joints for strips, shall be tinned soldered.

24.19.8. **Test Joints.** Testing joints shall be provided on down conductors in such a position that the testing is carried out without any inconvenience.

24.19.9. **Testing.** On completion of the work, testing shall be carried out in dry season as far as possible. The testing instruments shall be arranged by the contractor at site and testing should be carried out by the contractor in the presence of Engineer-in-Charge, without any extra payment

24.19.10. Details shown in Figure 24-1, 24-2 and 24-3 shall be followed as guidance.

**24.20. Electrical Tests.** Tests for insulation resistance and earth continuity resistance, as required by Electricity Regulations, Govt of Pakistan, shall be carried out by the licensed supervisor of the contractor in the presence of the Engineer-in-Charge and reports prepared and handed over to the later.

**24.21. Samples.** Two sets of samples of all normal fittings and accessories, conduit or conduit fittings, cables and wires which are to be supplied and fixed by the contractor shall be produced by the contractor for inspection/ approval of the Engineer-in-Charge. These samples shall be approved by the Engineer-in-Charge according to specifications. One set of approved samples shall be retained by the Engineer-in-Charge. No installation work shall proceed until such samples have been approved.

## METKK HOD OF MEASUREMENTS

**24.22.** Electric light work shall be measured "per point" and shall include any length of circuit for one room, passage or staircase etc. as required with all accessories and fittings as described in clarification of rates, connections to distribution boards and those specifically mentioned below:-

(1) Wiring for wall sockets will be paid as for lighting points.

(2) Extensions to existing circuits when ordered separately from lighting point will measure linear under appropriate item.

## CLARIFICATION OF RATES

**24.23.** The rates inter alia include particularly:-

(1) "Per point" include all accessories except socket outlets, pendants, brackets, lamp fittings, shades, lamps, switches, bells and fans.

(2) All subsidiary materials such as nails, screws, wall hooks and plugs etc.

(3) Cutting holes in or through walls, taking up and re-fixing flooring board, notching or drilling holes through joints and making good all disturbed surfaces to match existing works.

(4) Earthing of third pin point of socket, outlet as described upto Main Control common Earthing point.

(5) For fittings supplied by Ministry of Defence, removal from store together with all subsidiary materials including those of other trades necessary for fixing such fittings.

(6) In repairs, taking down any existing fittings and removal to store together with the making good of wall and ceiling surface etc.

(7) Testing the complete installation as may be required.

**NOTE :- For Lightning Conductor**

(1) Major metal work inside the building should be bonded to the lightning protection system.

(2) If rails are to be provided these should be properly earthed.

(3) If copper rod is to be used as earth electrode the process will be adopted as under:-

(a) Excavate a pit 30 cm x 30 cm x 30 cm

(b) Drive copper rod 15 mm dia direct into the ground.
(c) Clean the surface of copper strip to be jointed with driven copper rod.
(d) Clean the rod to be soldered with copper strip
(e) Solder copper strip rod.
(f) Screw up the strip with bolts and nuts.

(4) It is the discretion of the Engineer-in-Charge to select the type of Earth according to resistivity of soil.

**24.24 LED Luminaries.** LED lights must meet the minimum requirements as given in Table 24-5:-

**TABLE 24-5**
**Minimum Requirement for LED Lights**

| Ser | Activity | Illumination (lux, lumen/$m^2$) |
|---|---|---|
| (1) | Public areas with dark surroundings | 20-50 |
| (2) | Simple orientation for short visits | 50-100 |
| (3) | Working areas where visual tasks are only occasionally performed | 100-150 |
| (4) | Warehouses, Homes, Theatres, Archives | 150 |
| (5) | Easy Office Work, Classes | 250 |
| (6) | Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories | 500 |
| (7) | Supermarkets, Mechanical Workshops, Office Landscapes | 750 |
| (8) | Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres | 1000 |
| (9) | Detailed Drawing Work, Very Detailed Mechanical Works | 1500-2000 |
| (10) | Performance of visual tasks of low contrast and very small size of prolonged periods of time | 2000-5000 |
| {11) | Performance of very prolonged and exacting visual tasks | 5000-10000 |
| (12) | Performance of very special visual of extremely low contrast and small size | 10000-20000 |

24.24.1 LED luminaires must also meet the following minimum requirements:-

(1) Luminaires have a minimum 3 year manufacturer's warranty.
(2) Luminaires have a minimum lumen maintenance value of 35,000 hours as calculated by IES TM-21, with data obtained as per IES LM-80 requirements.
(3) Luminaires must be tested to IES LM-79 and IES LM-80 standard.

24.24.2 **LED Drivers.** LED Drivers should comply NEMA SSL 1, UL 8750. LED drivers must be electronic, UL Class 1, constant-current type and comply with the following requirements:-

(1) Output power (watts) and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.
(2) Power Factor (PF) greater than or equal to 0.8 over the full dimming range when provided.
(3) Current drawn Total Harmonic Distortion (THD) of less than 20 percent.
(4) Operable at input voltage of 120-277 volts at 50 hertz.
(5) Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.
(6) UL listed for dry or damp locations typical of interior installations.
(7) Surge protection device (SPD).

**24.25. Fans / Motors**

24.25.1 Ceiling fan, Exhaust fan, Bracket fan and Electric motor should be installed with 100% copper winding wire as per Pakistan standard specification.

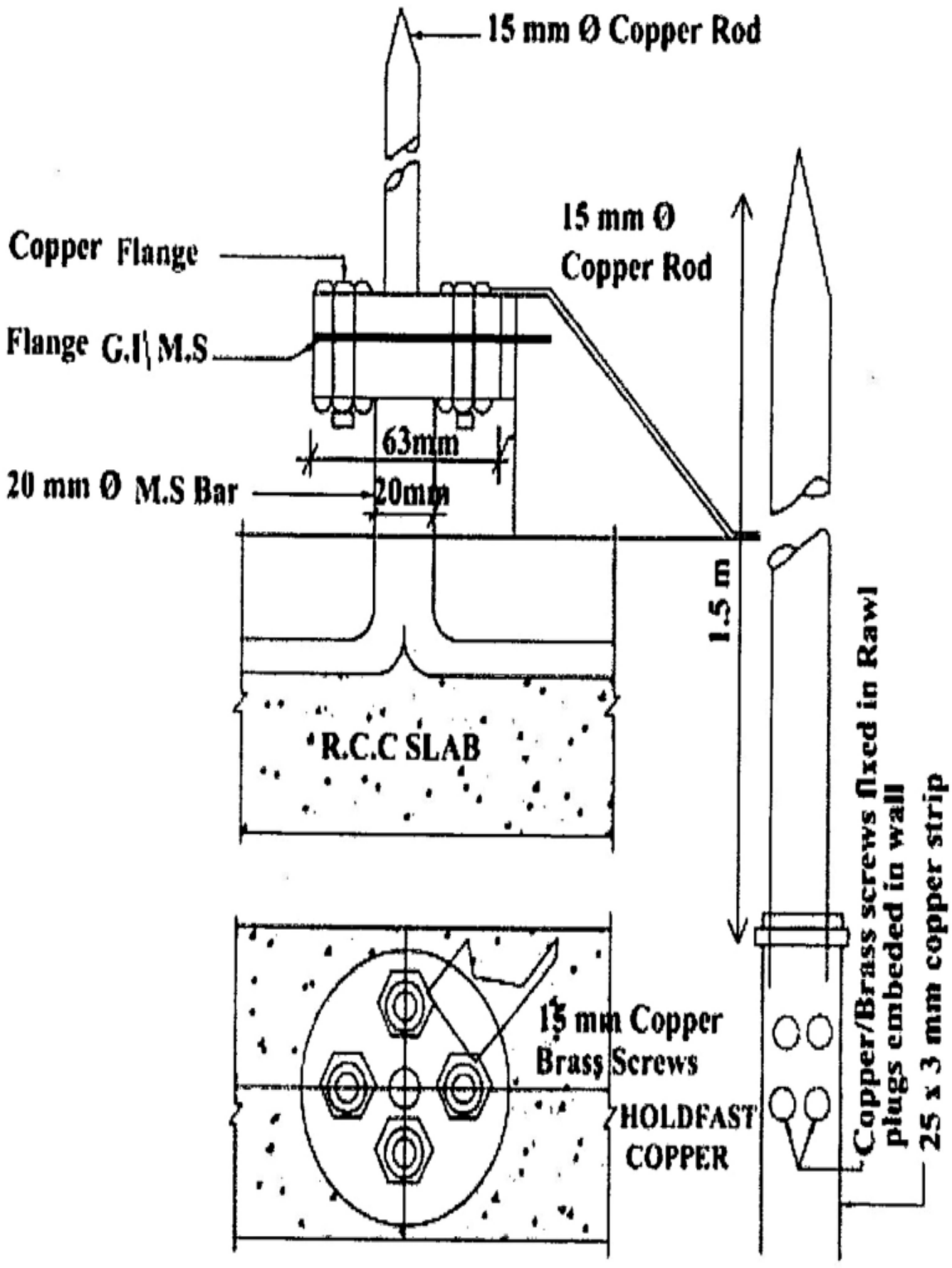



**FIGURE : 24-1**
**ARRANGEMENT FOR FIXING**
**LIGHTNING CONDUCTOR**

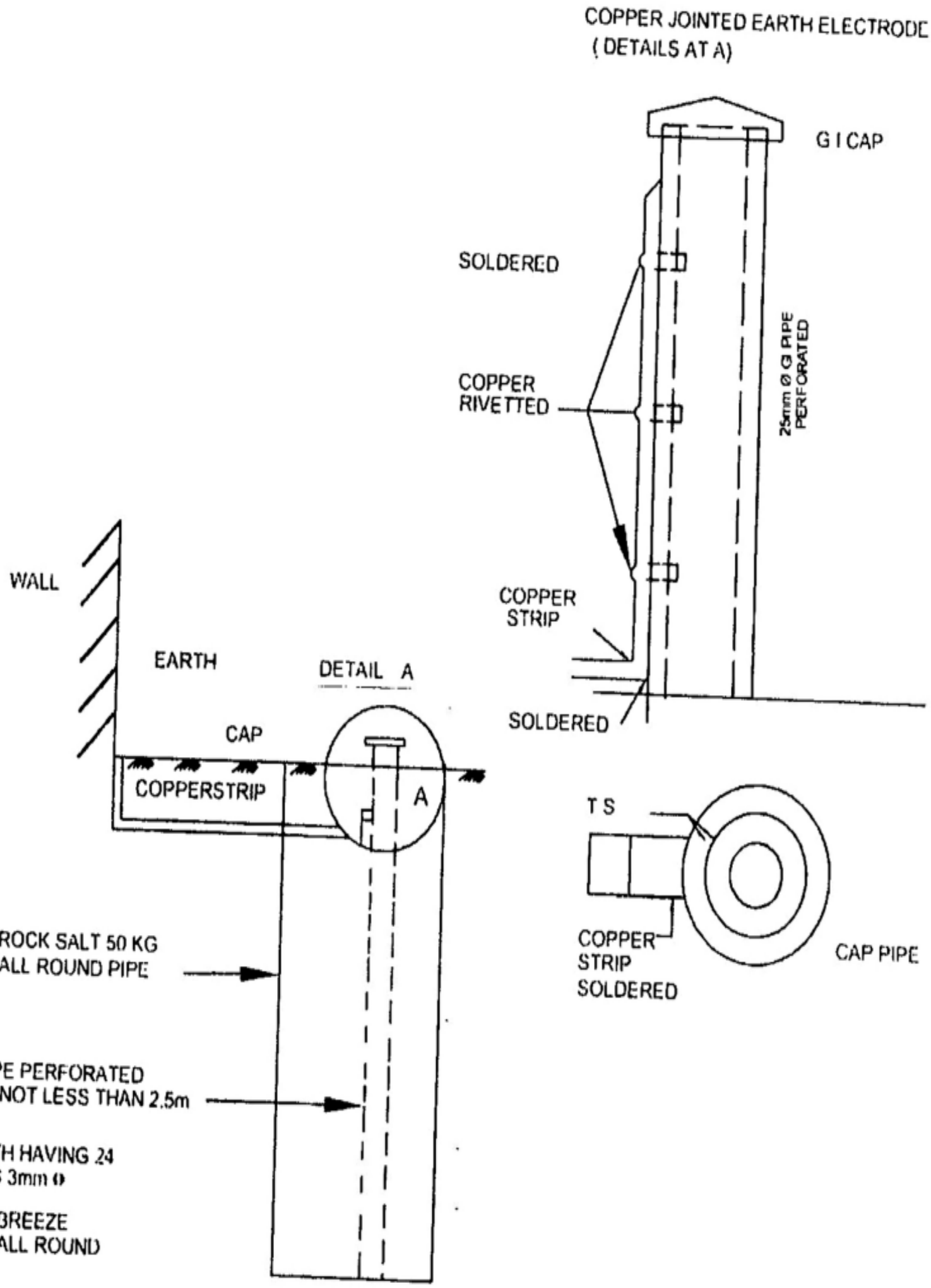
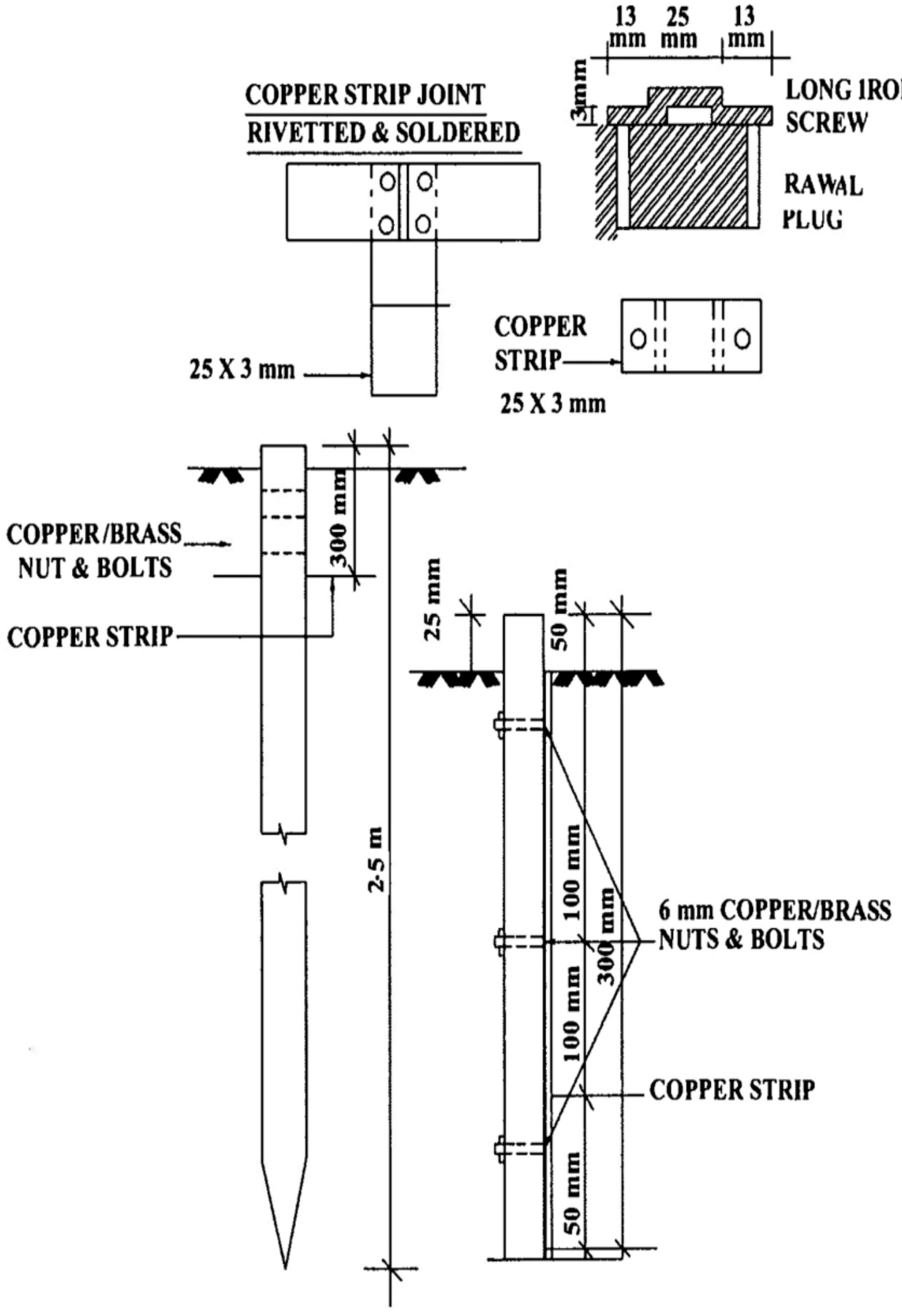



**FIGURE : 24-2**
**ARRANGEMENT FOR FIXING**
**LIGHTNING CONDUCTOR**
**(COPPER ROD EARTH ELECTRODE)**

FIGURE : 24-3




ARRANGEMENT FOR FIXING
LIGHTNING CONDUCTOR

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Wiring** | | |
| 24-1 | **One fan point or one light point or one bell point,** controlled by one switch, wiring complete with PVC, single core cable 1 $mm^2$, with **PVC Channel patty,** supply and fixing. | Point | 2289 |
| 24-2 | Same as item 24- 1 but 1.5 $mm^2$ | Point | 2464 |
| 24-3 | Same as item 24-1 or 24-2 but, fixing only. | Point | 690 |
| 24-4 | Add to item 24-1, 24-2, or 24-3, if removal only. | Point | 173 |
| 24-5 | **One fan point or one light point or oile bell point,** controlled by one switch, wiring complete, with PVC single core cable 1 $mm^2$, in **Surface conduit,** stove enamelled, supply and fixing. | Point | 3883 |
| 24-6 | Same as item 24-5, but in **Surface Flame proof conduit.** | Point | 5270 |
| 24-7 | Same as item 24-5, but in **Concealed PVC conduit.** | Point | 1627 |
| 24-8 | Same as item 24-5, but in **Surface PVC conduit.** | Point | 2005 |
| 24-9 | **One fan point or one light point or one bell point,** controlled by one switch, wiring complete, with PVC single core cable 1.5 $mm^2$, in **Surface conduit,** stove enamelled, supply and fixing. | Point | 4058 |
| 24-10 | Same as item 24-9, but **in Surface flame proof conduit.** | Point | 5445 |
| 24-11 | Same as item 24-9, but in **Concealed PVC conduit.** | Point | 1802 |
| 24-12 | Same as item 24-9, but in **Surface PVC conduit.** | Point | 2180 |
| 24-13 | Same as item 24-5 or 24-9, but fixing only. | Point | 1035 |
| 24-14 | Same as item 24-6 or 24-10, but fixing only. | Point | 1035 |
| 24-15 | Same as item 24-7 or 24-11, but fixing only. | Point | 375 |
| 24-16 | Same as item 24-8 or 24-12, but fixing only. | Point | 690 |
| 24-17 | Add to item 24-5, 24-9 or 24-13, if removal only. | Point | 345 |
| 24-18 | Add to item 24-6, 24-10 or 24-14, if removal only. | Point | 345 |
| 24-19 | Add to item 24-7, 24-11 or 24-15, if removal only. | Point | 289 |
| 24-20 | Add to item 24-8, 24-12 or 24-16, if removal only. | Point | 345 |
| 24-21 | **One fan point or one light point or one bell point controlled by one switch,** wiring complete with PVC single/ core cable 1 $mm^2$, but **without PVC channel patty** supply and fixing. | Point | 447 |
| 24-22 | Same as item 24-21, but 1.5 $mm^2$ | Point | 622 |
| 24-23 | Same as item 24-21, 24-22, but fixing only. | Point | 173 |
| 24-24 | Add to item 24-21, 24-22 or 24-23, if removal only. | Point | 173 |
| 24-25 | **One fan point or one light point or one bell point** controlled by one switch, wiring complete with PVC single core cable 1 $mm^2$, in **surface or concealed conduit,** but without conduit, supply and fixing. | Point | 619 |
| 24-26 | Same as item 24-25, but fixing only. | Point | 345 |
| 24-27 | Add to item 24-25, or 24-26, if removal only. | Point | 150 |
| 24-28 | **One fan point or one light point or one bell point** controlled by one switch, wiring complete with PVC single core cable 1.5 mm,2 in **Concealed or surfaced conduit,** stove enamelled, but without conduit, supply and fixing. | Point | 794 |
| 24-29 | Same as item 24-28, but fixing only. | Point | 345 |
| 24-30 | Add to item 24-28 to 24-29, if removal only | Point | 173 |
| 24-31 | Add for each additional light point on same switch circuit/ additional circuit, controlled by more than one switch, wiring, complete with PVC single core cable 1 $mm^2$, with PVC Channel patty , supply and fixing. | Point | 1076 |
| 24-32 | Same as item 24-31, but 1.5 $mm^2$ | Point | 1251 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-33 | Same as item 24-31, 24-32 but fixing only. | Point | 518 |
| 24-34 | Add to item 24-31, 24-32 or 24-33, if removal only | Point | 173 |
| 24-35 | Add for each additional light point , one bell point on same switch Circuit/ additional circuit, controlled by more than one push switch, wiring complete with PVC single core cable 1 mm,2 in **Surface conduit,** stove enamelled, supply and fixing. | Point | 1035 |
| 24-36 | Same as item 24-35, but in Surface **Flame proof conduit.** | Point | 1429 |
| 24-37 | Same as item 24-35, but in **concealed PVC conduit.** | Point | 747 |
| 24-38 | Same as item 24-35, but in **surface PVC conduit.** | Point | 758 |
| 24-39 | Add for each additional light point, bell point on same switch circuiU additional circuit, controlled by more than one push switch, wiring complete with PVC single core cable 1.5 $mm^2$ in **Surface** conduit, stove enamelled, supply and fixing. | Point | 1210 |
| 24-40 | Same as item 24-39, but in **Surface Flame proof conduit.** | Point | 1604 |
| 24-41 | Same as item 24-39, but in **Concealed PVC conduit.** | Point | 922 |
| 24-42 | Same as item 24-39, but in **Surface PVC conduit.** | Point | 933 |
| 24-43 | Same as item 24-35 or 24-39, but fixing only | Point | 259 |
| 24-44 | Same as item 24-36 or 24-40, but fixing only | Point | 345 |
| 24-45 | Same as item 24-37 or 24-41, but fixing only | Point | 345 |
| 24-46 | Same as item 24-38 or 24-42, but fixing only. | Point | 345 |
| 24-47 | Add to item 24-35, 24-39 or 24-43, if removal only. | Point | 129 |
| 24-48 | Add to item 24-36, 24-40 or 24-44, if removal only. | Point | 173 |
| 24-49 | Add to item 24-37, 24-41 or 24-45, if removal only. | Point | 173 |
| 24-50 | Add to item 24-38, 24-42 or 24-46, if removal only. | Point | 173 |
| 24-51 | Add for each additional light point, bell point on same switch circuit additional circuit, controlled by more than one push switch, wiring complete with PVC single core cable 1 $mm^2$, but without PVC Channel patty, supply and fixing. | Point | 447 |
| 24-52 | Same as item 24-51, but 1.5 $mm^2$ | Point | 622 |
| 24-53 | Same as item 24-51, 24-52 but fixing only | Point | 173 |
| 24-54 | Add to item 24-51, 24-52 or 24-53 if removal only | Point | 115 |
| 24-55 | Add for each additional light point, bell point on same switch circuit additional circuit, controlled by more than one push switch, wiring complete with PVC single core cable 1 $mm^2$ in **Surface conduit,** stove enamelled but without conduit, supply and fixing. | Point | 533 |
| 24-56 | Same as item 24-55, but in **Surface Flame proof conduit.** | Point | 533 |
| 24-57 | Same as item 24-55, but in **concealed PVC conduit.** | Point | 533 |
| 24-58 | Same as item 24-55, but in **surface PVC conduit** | Point | 533 |
| 24-59 | Add for each additional light point, bell point on same switch circuit\ additional circuit. controlled by more than one push switch, wiring complete with PVC single core cable 1.5 mm,$^2$ in Surface conduit, stove enamelled, but without conduit, supply and fixing | Point | 708 |
| 24-60 | Same as item 24-59, but in **Surface, Flame proof conduit.** | Point | 708 |
| 24-61 | Same as item 24-59, but in **Concealed PVC conduit.** | Point | 708 |
| 24-62 | Same as item 24-59, but in **Surface PVC conduit.** | Point | 708 |
| 24-63 | Same as item 24-55 to 24-62, but fixing only. | Point | 259 |
| 24-64 | Add to item 24-55 to 24-62 or 24-63, if removal only. | Point | 86 |
| 24-65 | One light point, controlled by two ways switch, wiring complete with PVC single core cable 1 $mm^2$, on **PVC Channel patty,** supply and fixing | Point | 2314 |
| 24-66 | Same as item 24-65, but 1.5 $mm^2$ | Point | 2524 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-67 | Same as item 24-65, 24-66 but fixing only. | Point | 1484 |
| 24-68 | Add to item 24-65, 24-66 or 24-67, if removal only. | Prnnt | 682 |
| 24-69 | One light point controlled by two way switch, wiring complete with PVC single core cable 1 $mm^2$ in **Surface conduit** stove enamelled, supply and fixing. | Point | 3353 |
| 24-70 | Same as item 24-69, but in **Surface Flame proof conduit.** | Point | 4740 |
| 24-71 | Same as item 24-69, but in **Concealed PVC conduit.** | Point | 1247 |
| 24-72 | Same as item 24-69, but in **Surface PVC conduit.** | Point | 1593 |
| 24-73 | One light point controlled by two way switch, wiring complete with PVC single core cable 1.5 $mm^2$ **Surface** conduits, stove enamelled, supply and fixing. | Point | 3563 |
| 24-74 | Same as item 24-73, but in **Surface Flame proof conduit.** | Point | 4951 |
| 24-75 | Same as item 24-73, but in **Concealed PVC conduit.** | Point | 1457 |
| 24-76 | Same as item 24-73, but in **Surface PVC conduit.** | Point | 1803 |
| 24-77 | Same as item 24-69, or 24-73, but fixing only. | Point | 1035 |
| 24-78 | Same as item 24-70, or 24-74, but fixing only. | Point | 1035 |
| 24-79 | Same as item 24-71, or 24-75, but fixing only. | Point | 375 |
| 24-80 | Same as item 24-72 or 24-76, but fixing only. | Point | 690 |
| 24-81 | Add to item 24-69, 24-73 or 24-77, if removal only. | Point | 345 |
| 24-82 | Add to item 24-70, 24-74 or 24-78, if removal only. | Point | 345 |
| 24-83 | Add to item 24-71, 24-75 or 24-79, if removal only. | Point | 465 |
| 24-84 | Add to item 24-72, 24-76 or 24-80, if removal only. | Point | 345 |
| 24-85 | One light point, controlled by two way switch, wiring, complete, with PVC single core cable 1 $mm^2$, but without PVC Channel patty, supply and fixing | Point | 674 |
| 24-86 | Same as item 24-85 but1.5 $mm^2$ | Point | 884 |
| 24-87 | Same as item 24-85, 24-86 but fixing only. | Point | 345 |
| 24-88 | Add to item 24-85, 24-86 or 24-87 if removal only. | Point | 173 |
| 24-89 | One light point controlled by two-way switch, wiring complete with PVC single core cable 1 $mm^2$ in **Concealed or surface conduit** but without conduit, supply and fixing. | Point | 674 |
| 24-90 | One light point controlled by two way switch, wiring complete with PVC single core cable 1.5 $mm^2$ in **Concealed or surface conduit,** but without conduit, supply and fixing. | Point | 794 |
| 24-91 | Same as item 24-89, 24-90 but fixing only. | Point | 345 |
| 24-92 | Add to item 24-89, 24-90 or 24-91, if removal only. | Point | 173 |
| 24-93 | Add for each additional light point on same switch circuit, wiring complete with PVC single core cable 1 $mm^2$, with PVC Channel patty, supply and fixing. | Point | 1555 |
| 24-94 | Same as item 24-93, but 1.5 $mm^2$ | | 1730 |
| 24-95 | Same as item 24-93, 24-94 but fixing only. | Point | 690 |
| 24-96 | Add to item 24-93, 24-94 or 24-95, if removal only | Point | 345 |
| 24-97 | Add for each additional light point on same switch two way circuit, wiring complete with PVC single core cable 1 $mm^2$ in **Surface conduit,** stove enamelled, supply and fixing. | Point | 1232 |
| 24-98 | Same as item 24-97, but in Surface flame proof conduit. | Point | 1804 |
| 24-99 | Same as item 24-97, but ifl **Concealed PVC conduit.** | Point | 830 |
| 24-100 | Same as item 24-97, but in **Surface, PVC conduit.** | Point | 8'i1 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-101 | Add for each additional light point on same switch 2 way circuit, wiring complete with PVC single core cable 1.5 $mm^2$ in **Surface conduit,** stove enamelled, supply and fixing. | Point | 1517 |
| 24-102 | Same as item 24-101, but in **Flame proof conduit.** | Point | 1979 |
| 24-103 | Same as item 24-101, but **in Concealed PVC conduit.** | Point | 1005 |
| 24-104 | Same as item 24-101, but in **Surface PVC conduit.** | Point | 986 |
| 24-105 | Same as item 24-97 or 24-101, but fixing only. | Point | 345 |
| 24-106 | Same as item 24-98 or 24-102, but fixing only. | Point | 345 |
| 24-107 | Same as item 24-99 or 24-103, but fixing only. | Point | 375 |
| 24-108 | Same as item 24-100 or 24-104, but fixing only. | Point | 345 |
| 24-109 | Add to item 24-97, 24-101 or 24-105, if removal only. | Point | 173 |
| 24-110 | Add to item 24-98, 24-102 or 24-106, if removal only. | Point | 173 |
| 24-111 | Add to item 24-99, 24-103 or 24-107, if removal only. | Point | 173 |
| 24-112 | Add to item 24-100, 24-104 or 24-108, if removal only. | Point | 173 |
| 24-113 | Add for each additional light point on same switch 2 way circuit, wiring complete with PVC single core cable 1 $mm^2$, but without **PVC Channel patty,** supply and fixing. | Point | 674 |
| 24-114 | Same as item 24-113, but1.5 $mm^2$ | Point | 794 |
| 24-115 | Same as item 24-113, 24-114 but fixing only. | Point | 345 |
| 24-116 | Add to item 24-113, 24-114 or 24-115, if removal only | Point | 173 |
| 24-117 | Add for each additional light point on same switch 2-way circuit, wiring complete with PVC single core cable 1 $mm^2$, in **Surface conduit** stove enamelled, but without conduit, supply and fixing. | Point | 619 |
| 24-118 | Same as item 24-117, but in **Surface Flame proof conduit.** | Point | 619 |
| 24-119 | Same as item 24-117, but in **Concealed PVC conduit.** | Point | 619 |
| 24-120 | Same as item 24-117, but in **Surface PVC conduit.** | Point | 619 |
| 24-121 | Add for each additional light point on Same switch 2-way circuit, wiring complete with PVC single core cable 1.5 $mm^2$ in **Surface conduit,** stove enamelled but without conduit, supply and fixing. | Point | 794 |
| 24-122 | Same as item 24-121, but in **Surface Flame proof conduit.** | Point | 794 |
| 24-123 | Same as item 24-121, but in **Concealed PVC conduit.** | Point | 794 |
| 24-124 | Same as item 24-121, but in **Surface PVC conduit.** | Point | 794 |
| 24-125 | Same as item 24-117 to 24-124, but fixing only. | Point | 345 |
| 24-126 | Add to item 24-117 to 24-124, or 24-125 if removal only. | Point | 173 |
| 24-127 | One three pin socket outlet, 5 A, point controlled by one switch, wiring complete with PVC single core Cable 1 $mm^2$, with PVC Channel patty, including earth wire, supply and fixing. | Point | 2232 |
| 24-128 | Same as item 24-129, but 1.5 $mm^2$ | Point | 2407 |
| 24-129 | Same as item 24-129, 24-130 but fixing only. | Point | 1035 |
| 24-130 | Add to item 24-129, 24-130 or 24-131, if removal only | Point | 173 |
| 24-131 | One three pin socket outlet, SA, point controlled by one switch, wiring complete with PVC single core cable 1 $mm^2$, in **Surface conduit,** enamelled including earth wire, supply and fixing. | Point | 3564 |
| 24-132 | Same as item 24-131, but in **Surface flame proof conduit.** | Point | 4477 |
| 24-133 | Same as item 24-131, but in **Concealed PVC conduit.** | Point | 2265 |
| 24-134 | Same as item 24-131, but in **Surface PVC conduit.** | Point | 2112 |
| 24-135 | One three pin socket outlet, 5 A, point controlled by one switch, wiring complete PVC with single core cable 1.5 $mm^2$ in **Surface conduit,** stove enamelled, including earth wire, supply and fixing. | Point | 3740 |
| 24-136 | Same as item 24-135, but in **Surface Flame proof conduit.** | Point | 4652 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-137 | Same as item 24-135, but in **Concealed PVC conduit.** | Point | 2440 |
| 24-138 | Same as item 24-135, but in **Surface PVC conduit.** | Point | 2287 |
| 24-139 | One three pin socket outlet, 5 A, point controlled by one switch, wiring complete with PVC single core cable, 1 $mm^2$, including earth wire, on PVC Channel patty, but without PVC Channel patty, supply and fixing. | Point | 792 |
| 24-140 | Same as item 24-139, but 1.5 $mm^2$ | Point | 967 |
| 24-141 | Same as item 24-139, 24-140 but fixing only. | Point | 518 |
| 24-142 | Add to item 24-139, 24-140 or 24-141, if removal only | Point | 173 |
| 24-143 | One three pin socket outlet, 5 A, point controlled by one switch, wiring complete with PVC single core cable 1 $mm^2$, in **Concealed or Surface conduit,** but without conduit and earth wire, supply and fixing. | Point | 620 |
| 24-144 | Same as item 24-143, but fixing only. | Point | 345 |
| 24-145 | Add to item 24-143, or 24-144, if removal only. | Point | 173 |
| 24-146 | One three pin socket outlet, 5 A, point controlled by one switch, wiring complete with PVC single core cable 1.5 $mm^2$, in **Concealed or Surface conduit** but without conduit and earth wire, supply and fixing. | Point | 794 |
| 24-147 | Same as item 24-146 but fixing only. | Point | 345 |
| 24-148 | Add to item 24-146 or 24-147, if removal only | Point | 173 |
| 24-149 | One three pin socket outlet, 15 A, point controlled by one switch, wiring complete with PVC single core cable 2.5 $mm^2$, on **PVC Channel Patty,** including earth wire, supply and fixing. | Point | 2708 |
| 24-150 | Same as item 24-149, but fixing only. | Point | 1035 |
| 24-151 | Add to item 24-149 or 24-150, if removal only. | Point | 690 |
| 24-152 | One three pin socket outlet, 15 A, point controlled by one switch, wiring complete with PVC single core cable 2.5 $mm^2$, in **Surface conduit** stove enamelled, including earth wire, supply and fixing. | Point | 3921 |
| 24-153 | Same as item 24-152, but in **Surface Flame proof conduit.** | Point | 4541 |
| 24-154 | Same as item 24-152, but in **Concealed PVC conduit.** | Point | 3127 |
| 24-155 | Same as item 24-152, but in **Surface PVC conduit.** | Point | 3054 |
| 24-156 | Same as item 24-131, 24-135 or 24-152, but fixing only. | Point | 1035 |
| 24-157 | Same as item 24-132, 24-136 or 24-153, but fixing only. | Point | 1500 |
| 24-158 | Same as item 24-133, 24-137 or 24-154 but fixing only. | Point | 1725 |
| 24-159 | Same as item 24-134, 24-138 or 24-155, but fixing only. | Point | 1035 |
| 24-160 | Add to item 24-131, 24-135, 24-152 or 24-156, if removal only. | Point | 690 |
| 24-161 | Add to item 24-132, 24-136, 24-153 or 24-157, if removal only. | Point | 690 |
| 24-162 | Add to item 24-133, 24-137, 24-154 or 24-158, if removal only. | Point | 690 |
| 24-163 | Add to item 24-134, 24-138, 24-155 or 24-159, if removal only. | Point | 690 |
| 24-164 | One three pin socket outlet, 15 A, point controlled by one switch, wiring complete with PVC single core cable 2.5 $mm^2$, but without PVC Channel Patty and earth wire,, supply and fixing. | Point | 1279 |
| 24-165 | Same as item 24-164, but fixing only. | Point | 517 |
| 24-166 | Add to item 24-164 or 24-165, if removal only. | Point | 172 |
| 24-167 | One three pin socket outlet, 15 A, point controlled by one switch, wiring complete with PVC single core cable 2.5 $mm^2$ copper conductor in **Concealed or Surface conduit** but without conduit, and earth wire, supply and fixing. | Point | 1279 |
| 24-168 | Same as item 24-167, but fixing only. | Point | 690 |
| 24-169 | Add to item 24-167 or 24-168, if removal only | Point | 345 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-170 | Copper conductor 14 SWG for 3 pin 5 A, or 3 pin, 15 A, socket outlet points, in Concealed or Surface conduit, but without conduit, supply and fixing. | Point | 364 |
| 24-171 | Same as item 24-170, but fixing only. | Point | 86 |
| 24-172 | Add to item 24-170 or 24-171, if removal only. | Point | 43 |
| 24-173 | Cable unsheathed for earth continuity conductor, 1 $mm^2$ used for light/ fan/ bell SA socket outlet points, where metallic boards/ housings, in **Concealed or Surface conduit,** but without conduit, supply and fixing. | Point | 180 |
| 24-174 | Same as item 24-173, but fixing only. | Point | 86 |
| 24-175 | Add to item 24-173 or 24-'i74, if removal only. | Point | 43 |
| 24-176 | Cable for earth continuity conductor 1.5 $mm^2$ used for 15 A socket outlet points, where metallic boards/housings are used, in **Concealed or Surface conduit,** but without conduit, supply and fixing. | Point | 266 |
| 24-177 | Same as item 24-176, but fixing only. | Point | 86 |
| 24-178 | Add to item 24-176 or 24-177, if removal only | Point | 43 |
| | **Fittings and Accessories For Pendants** | | |
| 24-179 | Pendant, ordinary, comprising ceiling rose, lamp holder Bakelite, BC, CG, with shade carrier ring and twin core 0.75 mm2 flexible cord upto 3 M in length, supply and fixing. | Each | 370 |
| 24-180 | Same as item 24-179, but without lamp holder | Each | 318 |
| 24-181 | Same as item 24-179, but fixing only. | Each | 86 |
| 24-182 | Same as item 24-180, but fixing only. | Each | 76 |
| 24-183 | Same as item 24-179 to 24-182, if removal only. | Each | 52 |
| | **Lamp Holder** | | |
| 24-184 | Lamp holder, batten BC, with shade carrier ring, 20 mm, all insulated reinforced linear, supply and fixing. | Each | 87 |
| 24-185 | Same as item 24-184, but 45° angle | Each | 87 |
| 24-186 | Lamp holder ES, CG, supply and fixing | Each | 87 |
| 24-187 | Lamp holder ES, threaded 20 mm dia, ET, supply and fixing. | Each | 102 |
| 24-188 | Lamp holder brass screw type for 500/300W Lamp, supply and fixing | Each | 184 |
| 24-189 | Same as item 24-184 to 24-188, but fixing only. | Each | 61 |
| 24-190 | Add to item 24-184 to 24-188, or 24-189 if removal only. | Each | 30 |
| | **LED Lights** | | |
| 24-191 | LED strip light 2 feet, 18 watt 220/240 volts for wall or ceiling mounted approved type **Standard,** Supply and fixing. | Each | 786 |
| 24-192 | Same as item 24-191 but **Deluxe** | Each | 1158 |
| 24-193 | Same as item 24-191 but **Premium** | Each | 2610 |
| 24-194 | LED strips light 4 feet, 36 watt 220/240 volts for wall or ceiling mounted approved type **Standard,** Supply and fixing. | Each | 1482 |
| 24-195 | Same as item 24-194 but **Deluxe** | Each | 1998 |
| 24-196 | Same as item 24-194 but **Premium** | Each | 3918 |
| 24-197 | Same as item 24-191 to 24-196, but fixing only. | Each | 138 |
| 24-198 | Add to item 24-191, 24-196 or 24-197, if removal only. | Each | 104 |
| 24-199 | LED Recessed panel light, 6 watts 220/240 volts, round or Square approved type **Standard** Supply and fixing. | Each | 735 |
| 24-200 | Same as item 24-199 but **Deluxe.** | Each | 1005 |
| 24-201 | Same as item 24-199 but **Premium.** | Each | 1289 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-202 | LED Recessed panel light, 12 watts 220/240 volts, round or Square, approved type, **Standard,** Supply and fixing. | Each | 1071 |
| 24-203 | Same as item 24-202 but **Deluxe.** | Each | 1395 |
| 24-204 | Same as item 24-202 but **Premium.** | Each | 1779 |
| 24-205 | LED Recessed panel light 18 watts, 220/240 volts, round or Square, approved type, **Standard** Supply and fixing. | Each | 1341 |
| 24-206 | Same as item 24-205 but **Deluxe.** | Each | 1865 |
| 24-207 | Same as item 24-205 but **Premium.** | Each | 2295 |
| 24-208 | LED Recessed panel light 24 watts, 220/240 volts, round or Square, approved type, **Standard** Supply and fixing. | Each | 2025 |
| 24-209 | Same as item 24-208 but **Deluxe.** | Each | 2073 |
| 24-210 | Same as item 24-208 but **Premium.** | Each | 4021 |
| 24-211 | Same as item 24-199 to 24-210, but fixing only. | Each | 345 |
| 24-212 | Add to item 24-199 to 24-210 or 24-211, if removal only. | Each | 173 |
| 24-213 | LED Surface Mounted panel light, 6 watts 220/240 volts, round or Square, approved type **Standard,** Supply and fixing | Each | 657 |
| 24-214 | Same as item 24-213 but **Deluxe.** | Each | 873 |
| 24-215 | Same as item 24-213 but **Premium.** | Each | 1436 |
| 24-216 | LED Surface Mounted panel light, 12 watts 220/240 volts, round or Square, approved type **Standard,** Supply and fixing | Each | 1099 |
| 24-217 | Same as item 24-216 but **Deluxe.** | Each | 1395 |
| 24-218 | Same as item 24-216 but **Premium.** | Each | 1863 |
| 24-219 | LED Surface Mounted panel light, 18 watts 220/240 volts, round or Square complete, approved type **Standard,** Supply and fixing | Each | 1375 |
| 24-220 | Same as item 24-219 but **Deluxe.** | Each | 1395 |
| 24-221 | Same as item 24-219 but **Premium.** | Each | 2235 |
| 24-222 | LED Surface Mounted panel light, 24 watts 220/240 volts, round or Square, approved type **Standard,** Supply and fixing. | Each | 2205 |
| 24-223 | Same as item 24-222 but **Deluxe.** | Each | 3813 |
| 24-224 | Same as item 24-222 but **Premium.** | Each | 4801 |
| 24-225 | Same as item 24-213 to 24-224, but fixing only. | Each | 345 |
| 24-226 | Add to item 24-213 to 24-224 or 24-225, if removal only. | Each | 173 |
| 24-227 | LED Down light, 7 watts, 220/240 volts, approved type, **Standard,** Supply and fixing. | Each | 690 |
| 24-228 | Same as item 24-227 but **Deluxe.** | Each | 780 |
| 24-229 | Same as item 24-227 but **Premium.** | Each | 840 |
| 24-230 | LED Down light, 12 watts, 220/240 volts, approved type, **Standard** Supply and fixing. | Each | 960 |
| 24-231 | Same as item 24-230 but **Deluxe** | Each | 1146 |
| 24-232 | Same as item 24-230 but **Premium** | Each | 1158 |
| 24-233 | LED Down light, 18 watts, 220/240 volts, approved type, **Standard.** Supply and fixing. | Each | 1230 |
| 24-234 | Same as item 24-233 but **Deluxe** | Each | 1398 |
| 24-235 | Same as item 24-233 but **Premium** | Each | 1758 |
| 24-236 | Same as item 24-227 to 24-235, but fixing only. | Each | 259 |
| 24-237 | Add to item 24-227 to 24-235 or 24-236, if removal only. | Each | 173 |
| 24-238 | LED/SMD Bulb, 5 watts, 220/240 volts, approved type supply and fixing | Each | 203 |
| 24-239 | Same as item 24-238 but, 7 watts. | Each | 186 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-240 | Same as item 24-238 but, 12 watts | Each | 207 |
| 24-241 | Same as item 24-238 but, 18 watts | Each | 400 |
| 24-242 | Same as item 24-238 but, 30 watts | Each | 609 |
| 24-243 | Same as item 24-238 but, 50 watts | Each | 1175 |
| 24-244 | Same as item 24-212 to 24-217, but fixing only. | Each | 35 |
| 24-245 | Add to item 24-212 to 24-217 or 24-218, if removal only. | Each | 28 |
| 24-246 | Switch SP, 5 A, **Piano type** single or two way mounted in cast or malleable iron galvanize conduit box, with solid metal or Bakelite plate, supply and fixing. | Each | 107 |
| 24-247 | Same as item 24-246, but fixing only | Each | 76 |
| 24-248 | Add to item 24-246 or 24-247, if removal only. | Each | 38 |
| 24-249 | **Switch water tight,** SP, 5- A, galvanized, front side operated, screwed, 20 mm, conduit terminal or through pattern, one way, supply and fixing. | Each | 433 |
| 24-250 | Same as item 24-249, but fixing only | Each | 121 |
| 24-251 | Add to item 24-249 or 24-250, if removal only | Each | 61 |
| 24-252 | Switch, SP, socket outlet 3 pin, 5 A, Universal/Multiple Bakelite, shuttered pattern, complete, supply and fixing. | Each | 183 |
| 24-253 | Same as item 24-252, but in galvanized, cast or malleable iron, in lieu of Bakelite box | Each | 378 |
| 24-254 | Same as item 24-252, 24-253, but fixing only. | Each | 121 |
| 24-255 | Add to item 24-252, 24-253 or 24-254, if removal only. | Each | 61 |
| 24-256 | Plug 3 pin, 5 A, supply and fixing. | Each | 71 |
| 24-257 | Same as item 24-256, but 15 A | Each | 123 |
| 24-258 | Same as item 24-256 or 24-257, but fixing only. | Each | 30 |
| 24-259 | Add to item 24-256, 24-257 or 24-258, if removal only. | Each | 15 |
| 24-260 | Switch, SP, socket out let 3 pin, 15 A, shuttered pattern, mounted in Bakelite box complete, supply and fixing. | Each | 271 |
| 24-261 | Switch, SP, Socket outlet, 3 pins, 20 A, shuttered pattern, mounted in Bakelite box, complete, supply and fixing. | Each | 348 |
| 24-262 | Switch, SP socket outlet 3 pin, 15 A, shuttered pattern, mounted in a weather proof CI case, drilled and tapped 20 mm, ET with screw on type, metal cap attached by chain, complete, supply and fixing. | Each | 511 |
| 24-263 | Same as item 24-260 to 24-262 but fixing only | Each | 121 |
| 24-264 | Add to item 24-260 to 24-262 or 24-263, if removal only. | Each | 61 |
| 24-265 | **Socket Outlet,** Industrial 380/400 V, 3 phase, neutral and earth, water proof 16A, supply and fixing. | Each | 1543 |
| 24-266 | Same as item 24-265, but 32A. | Each | 1867 |
| 24-267 | Same as item 24-265, but 63A. | Each | 5326 |
| 24-268 | Same as item 24-265 to 24-267 but fixing only. | Each | 607 |
| 24-269 | Add to item 24-265 to 24-267 or 24-268, if removal only. | Each | 304 |
| 24-270 | **Plug for Socket Outlet,** Industrial 380/400 V, 3 phase, neutral and earth, water proof, 16 A, supply and fixing. | Each | 776 |
| 24-271 | Same as item 24-270, but 32 A | Each | 1124 |
| 24-272 | Same as item 24-270, but 63 A | Each | 2975 |
| 24-273 | Same as item 24-270 to 24-271, but fixing only. | Each | 182 |
| 24-274 | Same as item 24-272, but fixing only | Each | 455 |
| 24-275 | Add to item 24-270 to 24-271 or 24-273, if removal only. | Each | 91 |
| 24-276 | Add to item 24-272 or 24-274 if removal only. | Each | 227 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Bulk head Fittings** | | |
| 24-277 | Bulk head fittings CI, without guard, tapped, 20 mm ET, according to BSS, supply and fixing | Each | 751 |
| 24-278 | Same as item 24-277, but with guard | Each | 818 |
| 24-279 | Bulk head fitting plastic body without guard, tapped 20 mm ET, according to BSS, complete approved type supply and fixing. | Each | 562 |
| 24-280 | Same as item 24-279 but with guard. | Each | 634 |
| 24-281 | Same as item 24-277 to 24-280, but fixing only. | Each | 152 |
| 24-282 | Add to item 24-277 to 24-280 or 24-281, if removal only. | Each | 76 |
| | **Earthing** | | |
| 24-283 | **Earth,** complete as described in Para 24.16 of the Specifications, with **8 SWG** copper conductor, supply and fixing. | Each | 5540 |
| 24-284 | Same as item 24-283, but with **6 SWG.** | Each | 5989 |
| 24-285 | Same as item 24-283, but with **2 SWG.** | Each | 7406 |
| 24-286 | Same as item 24-283, but with **3/0 SWG.** | Each | 9769 |
| 24-287 | Same as item 24-283 to 24-286, but fixing only. | Each | 2199 |
| 24-288 | Add to item 24-283 to 24-286 or 24-287, if removal only. | Each | 379 |
| | **Lightning Conductor** | | |
| 24-289 | Air termination for Lightning Conductor, with 15 mm dia copper rod, 150 cm long, with gunmetal copper base, 75 mm x 40 mm x 30 mm, fixed complete, with brass bolts, supply and fixing. | Each | 3381 |
| 24-290 | Same as item 24-289, but fixing only. | Each | 304 |
| 24-291 | Add to item 24-289 or 24-290, if removal only. | Each | 152 |
| 24-292 | **Down conductor,** roof conductor and conductor required for bonding exposed metal work to earthing conductor with copper strips, 25 mm x 3 mm, supply and fixing. | Metre | 1020 |
| 24-293 | Same as item 24-292, but fixing only. | Metre | 121 |
| 24-294 | Add to item 24-292 or 24-293, if removal only. | Metre | 61 |
| 24-295 | **Inspection joints,** cross, tee, straight as per site requirement, supply and fixing. | Each | 628 |
| 24-296 | Same as item 24-295, but fixing only | Each | 76 |
| 24-297 | Add to item 24-295 or 24-296, if removal only. | Each | 38 |
| 24-298 | **Earth** for Lightning conductor, complete as described in Para 24.19.6(2) of the Specifications, inclusive of copper strip upto test joint, supply and fixing. | Each | 7310 |
| 24-299 | Same as item 24-298, but as described in Para 24.19.6(1) of the Specifications. | Each | 8414 |
| 24-300 | Same as item 24-298 or 24-299, but fixing only. | Each | 2350 |
| 24-301 | Add to item 24-298, 24-299 or 24-300 if removal only. | Each | 607 |
| | **Energy Meter** | | |
| 24-302 | Analogue Electric Meter AC 220/250 V, single phase, 50 cycle upto 30 A, supply and fixing | Each | 2659 |
| 24-303 | Digital Electric Meter AC 220/250 V, single phase, 50 cycle upto 30 A, supply and fixing | Each | 5153 |
| 24-304 | Same as item 24-302, 24-303, but fixing only | Each | 380 |
| 24-305 | Add to item 24-302, 24-303 or 24-304, if removal only. | Each | 190 |
| 24-306 | Meter electric AC 400 volts, 3 phase, 50 cycle, 4 wire, 15-90 A, supply and fixing. | Each | 10117 |
| 24-307 | Same as item 24-306, but 100 A | Each | 10117 |
| 24-308 | Same as item 24-306, but 200 A complete with CTs | Each | 23351 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-309 | Digital Electric Meter (TOU) AC 400 volts, 3 phase, 50 cycle, 4 wire, 15-90 A, supply and fixing. | Each | 19471 |
| 24-310 | Same as item 24-309, but 100 A. | Each | 19471 |
| 24-311 | Same as item 24-309 but 200 A, complete with CTs. | Each | 28991 |
| 24-312 | Same as item 24-306, to 24-307 or 24-309 to 24-310, but fixing only. | Each | 759 |
| 24-313 | Same as item 24-308 or 24-311, but fixing only. | Each | 911 |
| 24-314 | Add to item 24-306 to 24-313, if removal only. | Each | 380 |
| | **Smart Meters** | | |
| 24-315 | Supply and fixing of Static 3-Phase, whole current Smart energy meter DLMS/COSEM complaint (TOD/TOU) with built in GSM/GPRS communication Module, Measuring the parameters i.e active power KWH, reactive power KVARH, Phase volts, Phase current, MDI, etc Power factor and demand/schedual automatic meter reading i.e hourly, daily weekly monthly, 440 volt, 3 Phase, four wire, 50HZ all as specified. | Each | 20111 |
| 24-316 | Same as item 24-315, but single Phase 220/240 volts | Each | 10511 |
| 24-317 | Same as item 24-315, 24-316 but fixing only | Each | 911 |
| 24-318 | Add to item 24-315, 24-316 or 24-317, if removal only. | Each | 455 |
| | **Flame Proof Fittings** | | |
| 24-319 | **Switch Flame proof,** SP, 5 A, drilled and tapped on both sides, solid brass threaded plug for fitting the hole not required. The switch and cover be completely inter-locked, supply and fixing. (The complete unit should comply with BSS No.229, 542 and 889) | Each | 1126 |
| 24-320 | Switch socket flame proof, 3 pin 5 A, complete as specified, supply and fixing. | Each | 6048 |
| 24-321 | Same as item 24-319, but 15 A | Each | 9895 |
| 24-322 | Flame proof Plug & Socket Outlet, industrial 380/400 V, 3 phase, neutral and earth, water protected 16A complete, approved type supply and fixing. | Each | 31698 |
| 24-323 | Same as Item 24-322 but 32 A. | Each | 34559 |
| 24-324 | Same as Item 24-322 but 63 A. | Each | 40110 |
| 24-325 | Same as item 24-319 to 24-324, but fixing only. | Each | 152 |
| 24-326 | Add to item 24-319 to 24-324 or 24-325, if removal only | Each | 76 |
| 24-327 | **Switch fuse Flame proof,** SP, 250 V, 15 A, terminal chamber drilled and tapped, 25 mm ET on both sides, solid brass threaded plug for sealing hole not required, supply and fixing (The complete unit should comply with BSS No 229, 542 and 889). | Each | 6190 |
| 24-328 | Same as item 24-327, but 250/500 V, 30 A | Each | 7210 |
| 24-329 | Same as item 24-327, but TPNL, 500 V, 15 A | Each | 10207 |
| 24-330 | Same as item 24-327, but TPNL, 500 V, 30 A | Each | 17407 |
| 24-331 | Same as item 24-327, but TPNL, 500 V, 60 A | Each | 25063 |
| 24-332 | Same as item 24-327, but TPNL, 500 V, 100 A | Each | 36447 |
| 24-333 | Same as item 24-327, but TPNL, 500 V, 200 A | Each | 62544 |
| 24-334 | Same as item 24-327, but TPNL, 500 V, 300 A | Each | 79980 |
| 24-335 | Same as item 24-327, but fixing only | Each | 190 |
| 24-336 | Same as item 24-328, but fixing only | Each | 190 |
| 24-337 | Same as item 24-329, but fixing only | Each | 607 |
| 24-338 | Same as item 24-330, but fixing only | Each | 607 |
| 24-339 | Same as item 24-331 or 24-332, but fixing only | Each | 1063 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-340 | Same as item 24-333 or 24-334, but fixing only | Each | 1518 |
| 24-341 | Add to item 24-327, 24-328, 24-335 or 24-336, if removal only | Each | 95 |
| 24-342 | Add to item 24-329, 24-330, 24-336 or 24-337, if removal only | Each | 304 |
| 24-343 | Add to item 24-331 to 24-332 or 24-338, if removal only | Each | 531 |
| 24-344 | Add to item 24-333, 24-334 or 24-339, if removal only | Each | 759 |
| 24-345 | **Flame proof fitting,** 20 mm ET tapped entry, CI body, grey painted, with heavy glass cemented to fixed ring, strong wire guard and lamp holder with terminal chamber, internal connections of solid metal passing through insulating sleeves dispersive or angle type, vitreous enamelled reflector, over all height 300 mm and overall dia 175 mm, suitable for 60/100 W lamp, supply and fixing. | Each | 4203 |
| 24-346 | Same as item 24-345, but rectangular, approved type, suitable to take upto 150W lamp. | Each | 7172 |
| 24-347 | Same as item 24-345 or 24-346, but fixing only. | Each | 152 |
| 24-348 | Add to item 24-345, 24-346 or 24-347 if removal only. | Each | 76 |
| 24-349 | Spare glass and ring for item 24-345 or 24-346, supply and fixing. | Each | 796 |
| 24-350 | Same as item 24-349, but fixing only. | Each | 76 |
| 24-351 | Add to item 24-349 or 24-350, if removal only. | Each | 38 |
| | **Switch Fuses** | | |
| 24-352 | **Change over switch,** 15 A, SP, 250 V, 50 cycles, DP, wall mounted type, supply and fixing. | Each | 1052 |
| 24-353 | Same as item 24-352 but 30 A | Each | 1652 |
| 24-354 | **Change over switch,** 30 A, TP with NL, wall mounted type, supply and fixing. | Each | 3900 |
| 24-355 | Same as item 24-354, but 60 A. | Each | 5594 |
| 24-356 | Same as item 24-354, but 100 A. | Each | 8798 |
| 24-357 | Same as item 24-354, but 200 A. | Each | 16361 |
| 24-358 | Same as item 24-354, but 300 A. | Each | 18641 |
| 24-359 | Same as item 24-354, but 400 A. | Each | 33813 |
| 24-360 | Same as item 24-354, but 500 A. | Each | 42717 |
| 24-361 | Same as item 24-352 to 24-355, but fixing only. | Each | 345 |
| 24-362 | Same as item 24-356 to 24-358, but fixing only. | Each | 518 |
| 24-363 | Same as item 24-359 to 24-360, but fixing only. | Each | 690 |
| 24-364 | Add to item 24-352 to 24-355 or 24-360, if removal only. | Each | 259 |
| 24-365 | Add to item 24-356 to 24-360 or 24-362, 24-363, if removal only. | Each | 455 |
| | **MCCBsSP** | | |
| 24-366 | MCCB, SP, 6 to 63 A. (Breaking capacity 6 KA), supply and fixing | Each | 540 |
| 24-367 | Same as item 24-366 but **double pole.** | Each | 1383 |
| 24-368 | **Circuit breaker,** built in plug type, 3 pin (Breaking capacity 6 KA) 6 to 20 A, supply and fixing. | Each | 898 |
| 24-369 | Same as item 24-366 to 24-368, but fixing only. | Each | 86 |
| 24-370 | Add to item 24-366 to 24-368 or 24-369 if removal only. | Each | 57 |
| | **MCCB 3 Pole** | | |
| 24-371 | MCCB, 3 Pole 500/600 V, 50/60 cycles, complete with thermal and magnetic trips, 3 to 30 A, (breaking capacity 2.5 KA), supply and fixing. | Each | 4853 |
| 24-372 | Same as item 24-371, but 40 to 50 A. | Each | 5086 |
| 24-373 | Same as item 24-371, but 15 to 60 A (breaking capacity 5 KA). | Each | 5213 |
| 24-374 | Same as item 24-371, but 75 to 100 A (breaking capacity 5 KA). | Each | 6078 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-375 | Same as item 24-371, but 125 to 225 A (breaking capacity 18 KA). | Each | 11958 |
| 24-376 | Same as item 24-371, but 250 to 400 A (breaking capacity 25 KA). | Each | 14167 |
| 24-377 | Same as item 24-371, but 500 to 600 A (breaking capacity 25 KA) | Each | 55118 |
| 24-378 | Same as item 24-371, but 800 A with external handle (breaking capacity 45 KA). | Each | 59970 |
| 24-379 | Same as item 24-371, but 1000 A with external handle (breaking capacity 85 KA) | Each | 164490 |
| 24-380 | Same as item 24-371, but 1250 A with external handle (breaking capacity 85 KA) | Each | 181290 |
| 24-381 | Same as item 24-371, 24-372 or 24-373, but fixing only. | Each | 173 |
| 24-382 | Same as item 24-374 or 24-375, but fixing only. | Each | 259 |
| 24-383 | Same as item 24-376 or 24-377, but fixing only. | Each | 518 |
| 24-384 | Same as item 24-378 to 24-380, but fixing only | Each | 690 |
| 24-385 | Add to item 24-371 to 24-373 or 24-381, if removal only. | Each | 114 |
| 24-386 | Add to item 24-374 to 24-375, or 24-382, if removal only. | Each | 171 |
| 24-387 | Add to item 24-376 to 24-377 or 24-383, if removal only. | Each | 342 |
| 24-388 | Add to item 24-378 to 24-380 or 24-384, if removal only. | Each | 342 |
| | **MCCB 4 Pole** | | |
| 24-389 | MCCB 4 Pole, 500 / 600 V, 50/60 Cycles, complete with thermal and magnetic trip 3 to 30 A (Breaking capacity 2.5 KV), supply and fixing. | Each | 8378 |
| 24-390 | Same as item 24-389 but 40 to 50 A. | Each | 8378 |
| 24-391 | Same as item 24-389 but 60 to 100 A. | Each | 8378 |
| 24-392 | Same as item 24-389 but 125 A. | Each | 10515 |
| 24-393 | Same as item 24-389 but 160 to 250 A breaking capacity. | Each | 14618 |
| 24-394 | Same as item 24-389 but 300 to 400 A (Breaking capacity 50 KA). | Each | 36415 |
| 24-395 | Same as item 24-389 but 500 to 630 A (Breaking capacity 50 KA). | Each | 51800 |
| 24-396 | Same as item 24-389 but 800 A with external handle (Breaking capacity 50 KA). | Each | 87869 |
| 24-397 | Same as item 24-396 but 1000 A (Breaking capacity 70 KA). | Each | 144280 |
| 24-398 | Same as item 24-397 but 1250 A. | Each | 185305 |
| 24-399 | Same as item 24-389 to 24-391 but fixing only. | Each | 173 |
| 24-400 | Same as item 24-392 to 24-393 but fixing only. | Each | 259 |
| 24-401 | Same as item 24-394 to 24-395 but fixing only. | Each | 518 |
| 24-402 | Same as item 24-396 to 24-398 but fixing only. | Each | 690 |
| 24-403 | Add to item 24-389 to 24-391 or 24-399 if removal only. | Each | 114 |
| 24-404 | Add to item 24-392 to 24-393 or 24-400 if removal only. | Each | 171 |
| 24-405 | Add to item 24-394 to 24-395 or 24-401 if removal only. | Each | 342 |
| 24-406 | Add to item 24-396 to 24-398 or 24-402 if removal only. | Each | 449 |
| 24-407 | Earth leakage circuit breakers, 4 pole, 500/660 V, 50/60 cycle, complete with earth leakage, over load and short circuit protection, 15 to 100 A (breaking capacity 14 KA, at 415 V), supply and fixing. | Each | 37781 |
| 24-408 | Same as item 24-407, but 200 A (breaking capacity 35 KA). | Each | 62191 |
| 24-409 | Same as item 24-407, but fixing only. | Each | 345 |
| 24-410 | Same as item 24-408, but fixing only. | Each | 345 |
| 24-411 | Add to item 24-407 or 24-409, if removal only. | Each | 121 |
| 24-412 | Add to item 24-408 or 24-410, if removal only. | Each | 114 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Bus Bar Chamber** | | |
| 24-413 | Bus bar chamber, 600/610 mm long, steel sheet / Cl with hinged cover, hard drawn copper bus bars mounted on well insulated with micanite or other approved insulating material frames, complete with main and branch cables, socket and terminals, enamel paint inside and black outside, 500 V, 60/100 A, 4 bars, 400 mm height, 175-225 mm depth, supply and fixing. | Each | 11410 |
| 24-414 | Same as item 24-413, but 500 V, 200 A. | Each | 12743 |
| 24-415 | Same as item 24-413, but 500 V, 300 A. | Each | 13769 |
| 24-416 | Same as item 24-413, but 500 V, 500 A. | Each | 16025 |
| 24-417 | Same as item 24-413 to 24-416, but fixing only. | Each | 518 |
| 24-418 | Add to item 24-413 to 24-416 or 24-417, if removal only. | Each | 342 |
| | **Conduit** | | |
| 24-419 | **Conduit** 20 mm dia, heavy gauge Class-"B", screwed, complete with bends, tees, boxes, saddles etc, stove enamelled for **Surface wiring,** supply and fixing. | Metre | 248 |
| 24-420 | Same as item 24-419, but 25 mm dia. | Metre | 290 |
| 24-421 | Same as item 24-419, but 40 mm dia. | Metre | 426 |
| 24-422 | Same as item 24-419, but 50 mm dia. | Metre | 675 |
| 24-423 | Same as item 24-419, or 24-420, but fixing only | Metre | 86 |
| 24-424 | Same as item 24-421 or 24-422, but fixing only. | Metre | 104 |
| 24-425 | Add to item 24-419, 24-420 or 24-423, if removal only. | Metre | 57 |
| 24-426 | Add to item 24-421, 24-422 or 24-424, if removal only. | Metre | 68 |
| 24-427 | **Conduit** 20 mm dia, heavy gauge Class "B" screwed complete with all bends, tees, boxes, saddles etc, stove enamelled for **Concealed wiring,** supply and fixing. | Metre | 523 |
| 24-428 | Same as item 24-427, but 25 mm dia. | Metre | 565 |
| 24-429 | Same as item 24-427, but 40 mm dia. | Metre | 695 |
| 24-430 | Same as item 24-427, but 50 mm dia. | Metre | 943 |
| 24-431 | Same as item 24-427 or 24-428, but fixing only. | Metre | 328 |
| 24-432 | Same as item 24-429 or 24-430, but fixing only. | Metre | 328 |
| 24-433 | Add to item 24-427, 24-428 or 24-431, if removal only. | Metre | 178 |
| 24-434 | Add to item 24:..429 to 24-430 or 24-432, if removal only. | Metre | 196 |
| 24-435 | **PVC conduit,** 20 mm dia, complete with all bends, tees, boxes, saddles etc for **Surface wiring,** and **concealed wiring,** supply and fixing. | Metre | 134 |
| 24-436 | Same as item 24-435, but 25 mm dia. | Metre | 154 |
| 24-437 | Same as item 24-435, but 40 mm dia. | Metre | 270 |
| 24-438 | Same as item 24-435, but 50 mm dia. | Metre | 357 |
| 24-439 | Same as item 24-435 or 24-436, but fixing only | Metre | 72 |
| 24-440 | Same as item 24-437 or 24-438, but fixing only. | Metre | 86 |
| 24-441 | Add to item 24-435, 24-436 or 24-439, if removal only. | Metre | 45 |
| 24-442 | Add to item 24-437, 24-438 or 24-440, if removal only. | Metre | 55 |
| 24-443 | **Add to Item 24-435 to 24-438 if grooving/cut is required including** refilling and dressing of groves / cuts. | Metre | 298 |
| 24-444 | **Conduit,** 20 mm dia, heavy gauge Class-"B", screwed, solid drawn, complete with all bends, tees, boxes saddels etc., stove enamelled for surface wiring, supply and fixing (fittings shall be flame proof and conform to BS No. 229 and 889). | Metre | 456 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-445 | Same as item 24-444, but 25 mm dia. | Metre | 548 |
| 24-446 | Same as item 24-444, but 40 mm dia. | Metre | 770 |
| 24-447 | Same as item 24-444, but 50 mm dia. | Metre | 1061 |
| 24-448 | Same as item 24-444 to 24-447 but fixing only. | Metre | 86 |
| 24-449 | Add to item 24-444 to 24-447 or 24-448, if removal only. | Metre | 55 |
| 24-450 | **Bell Push,** 3A, 250 V, supply and fixing. | Each | 140 |
| 24-451 | Same as item 24-450, but fixing only. | Each | 35 |
| 24-452 | Add to item 24-450 or 24-451, if removal only. | Each | 21 |
| 24-453 | **Electric bell,** AC/DC, Bakelite case, pressed iron frame, steel contact spring and nickel plated, brass contact pillars both having silver contact points round and nickel / CP steel gong, supply and fixing. | Each | 326 |
| 24-454 | Same as item 24-453, but fixing only. | Each | 52 |
| 24-455 | Add to item 24-453 or 24-454, if removal only. | Each | 34 |
| 24-456 | **Buzzer,** Bakelite case, suitable for operation on AC/DC, main supply 100/110 V and 200/250 V, supply and fixing. | Each | 218 |
| 24-457 | Same as item 24-456, but fixing only. | Each | 52 |
| 24-458 | Add to item 24-456 or 24-457, if removal only. | Each | 34 |
| | **Fan Works** | | |
| 24-459 | Take down fan, clean externally, bearings, dust field coils, armature, commutater, provide fresh clean lubricant (oil or grease as required), adjust for sweep running, fix blades and re-fix complete in position | Each | 568 |
| 24-460 | Same as item 24-459, but fixing only. | Each | 518 |
| 24-461 | Clamp hook for fan, ordinary type, supply and fixing. | Each | 254 |
| 24-462 | Same as item 24-461, but box concealed or for girder. | Each | 259 |
| 24-463 | Same as item 24-461 or 24-462, but fixing only. | Each | 86 |
| 24-464 | Add to item 24-461, 24-462 or 24-463, if removal only. | Each | 55 |
| 24-465 | **Fan electric** with copper winding, blades, canopy and rod including connection, provision of cable and ceiling rose, for fan 140 cm and 120 cm sweep, without regulator "Standard", supply and fixing. | Each | 5247 |
| 24-466 | Same as item 24-465 but Deluxe. | Each | 5606 |
| 24-467 | Same as item 24-465, but Premium. | Each | 7842 |
| 24-468 | Same as item 24-465, but 90 cm sweep. | Each | 3530 |
| 24-469 | Fan electric, **Water proof** with copper winding blades, canopy and rod including connection, provision of cable and ceiling rose for fan, 140 and 120 cm sweep, (without regulator) of approved type, supply and fixing. | Each | 4864 |
| 24-470 | Fan electric, **Energy Efficient** with remote control, AC/DC 220 V, 30/40 Watt copper winding, blades, canopy and rod including connection, provision of cable and ceiling rose for fan, 140 and 120 cm sweep, (without regulator) of approved type, supply and fixing. | Each | 5873 |
| 24-471 | Same as item 24-465 to 24-470, but fixing only. | Each | 259 |
| 24-472 | Add to item 24-465 to 24-470 or 24-471, if removal only. | Each | 169 |
| | **Wall Bracket Fan** | | |
| 24-473 | Wall Bracket Fan Fancy with copper winding, plastic body 12" & 14" **"Standard"** Supply & fixing. | Each | 3177 |
| 24-474 | Same as item 24-473 but **Deluxe.** | Each | 3503 |
| 24-475 | Same as item 24-473 but **Premium.** | Each | 3697 |
| 24-476 | Wall Bracket Fan Fancy with copper winding, plastic body 20" & 24" **"Standard"** Supply & fixing. | Each | 4954 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-477 | Same as item 24-476, but **Deluxe.** | Each | 5825 |
| 24-478 | Same as item 24-476, but **Premium.** | Each | 7461 |
| 24-479 | Same as item 24-473 to 24-478, but fixing only. | Each | 86 |
| 24-480 | Add to item 24-473 to 24-478 or 24-479, if removal only. | Each | 35 |
| | **Cassette Fan AC** | | |
| 24-481 | Cassette type fan 2' x 2' with copper winding & remote control, including connection, provision of cable best quality supply and fixing. | Each | 7755 |
| 24-482 | Same as item 24-481, but fixing only. | Each | 104 |
| 24-483 | Add to item 24-481 or 24-482, if removal only. | Each | 52 |
| | **Switch/Socket** | | |
| 24-484 | **Switch,** SP, Bakelite, **Piano type,** 5 A, all insulated, one way, supply and fixing. | Each | 102 |
| 24-485 | **Switch,** SP, Bakelite, **Piano type,** 5 A, all insulated two ways, supply and fixing. | Each | 94 |
| 24-486 | **Socket outlet,** 5 A, Bakelite, 2-pin, **concealed type,** supply and fixing; | Each | 88 |
| 24-487 | **Dimmer,** for ceiling fan, any sweep supply and fixing. | Each | 196 |
| 24-488 | Same as item 24-484 to 24-487, but fixing only. | Each | 52 |
| 24-489 | Add to item 24-484 to 24-487 or 24-488, if removal only. | Each | 26 |
| | **Electric Motors** | | |
| 24-490 | **Motor electric** AC, 400 V, 3 phase, 50 cycles, 1450 / 2900 RPM, 1 HP, solid shaft horizontal, motor efficiency class IE-2, Insulation class F & Enclosure class IP55, supply and fixing. | Each | 44624 |
| 24-491 | Same as item 24-490, but 2 HP. | Each | 60068 |
| 24-492 | Same as item 24-490, but 3 HP. | Each | 80706 |
| 24-493 | Same as item 24-490, but 5 HP. | Each | 107526 |
| 24-494 | Same as item 24-490, but 7.5 HP. | Each | 131198 |
| 24-495 | Same as item 24-490, but 10 HP. | Each | 157946 |
| 24-496 | Same as item 24-490, but 15 HP. | Each | 207746 |
| 24-497 | Same as item 24-490, but 20 HP. | Each | 274130 |
| 24-498 | Same as item 24-490, but 25 HP. | Each | 356348 |
| 24-499 | Same as item 24-490, but 30 HP. | Each | 419828 |
| 24-500 | Same as item 24-490, but 40 HP. | Each | 507428 |
| 24-501 | Same as item 24-490, but 60 HP. | Each | 776228 |
| 24-502 | Same as item 24-490, but 75 HP. | Each | 936428 |
| 24-503 | Same as item 24-490, but 100 HP. | Each | 1274565 |
| 24-504 | Same as item 24-490, but 125 HP. | Each | 1501365 |
| 24-505 | Same as item 24-490 but 150 HP. | Each | 1841670 |
| 24-506 | Same as item 24-490, but 180 HP. | Each | 2213670 |
| 24-507 | Same as item 24-490 to 24-494, but fixing only. | Each | 398 |
| 24-508 | Same as item 24-495 to 24-497, but fixing only. | Each | 986 |
| 24-509 | Same as item 24-498 to 24-500, but fixing only. | Each | 2228 |
| 24-510 | Same as item 24-501 or 24-502, but fixing only. | Each | 2250 |
| 24-511 | Same as item 24-503 or 24-504, but fixing only. | Each | 2565 |
| 24-512 | Same as item 24-505 or 24-506, but fixing only. | Each | 3270 |
| 24-513 | Add to item 24-490 to 24-494 or 24-507, if removal only. | Each | 262 |
| 24-514 | Add to item 24-495 to 24-497 or 24-508, if removal only. | Each | 654 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-515 | Add to item 24-498 to 24-500 or 24-509, if removal only. | Each | 1480 |
| 24-516 | Add to item 24-501 to 24-502 or 24-510, if removal only. | Each | 1480 |
| 24-517 | Add to item 24-503 to 21--504 or 24-511, if removal only | Each | 1705 |
| 24-518 | Add to item 24-505 to 24-506 or 24-512, if removal only. | Each | 2158 |
| | **Rewinding** | | |
| 24-519 | Rewinding of **electric motor,** SP, 50 cycle, 220/230 V, with copper insulated conductor complete, upto 1/2 HP. | Each | 2564 |
| 24-520 | Same as item 24-519, but over 1/2 HP and upto 1 HP. | Each | 4200 |
| 24-521 | Same as item 24-519, but over 1 HP and upto 2 HP. | Each | 6000 |
| 24-522 | Rewinding of **electric motor,** AC, 400 V, 3 phase, 50 cycles, 1450/2900 RPM, complete as per original winding with copper insulated conductor upto 1 HP. | Each | 4200 |
| 24-523 | Same as item 24-522, but over 1 HP and upto 3 HP. | Each | 6000 |
| 24-524 | Same as item 24-522, but over 3 HP and upto 5 HP. | Each | 7200 |
| 24-525 | Same as item 24-522 but over 5 HP and upto 7.5 HP. | Each | 12000 |
| 24-526 | Same as item 24-522 but over 7.5 HP and upto 10 HP. | Each | 15385 |
| 24-527 | Same as item 24-522 but over 10 HP and upto 15 HP. | Each | 21026 |
| 24-528 | Same as item 24-522 but over 15 HP and upto 20 HP. | Each | 25128 |
| 24-529 | Same as item 24-522 but over 20 HP and upto 25 HP. | Each | 29231 |
| 24-530 | Same as item 24-522 but over 25 HP upto 30 HP. | Each | 37436 |
| 24-531 | Same as item 24-522 but over 30 HP upto 40 HP. | Each | 44615 |
| 24-532 | Same as item 24-522 but over 40 HP upto 50 HP. | Each | 55897 |
| 24-533 | Same as item 24-522 but over 50 HP upto 60 HP. | Each | 64821 |
| 24-534 | Same as item 24-522 but over 60 HP upto 70 HP. | Each | 75590 |
| 24-535 | Same as item 24-522 but over 70 HP upto 80 HP. | Each | 86400 |
| 24-536 | **Rewinding of Ceiling fan,** AC 220/ 230 V, 50 cycles, 140 cm sweep, complete as per original winding with copper insulated conductor. | Each | 1920 |
| 24-537 | Same as item 24-536, but 120 cm sweep. | Each | 1846 |
| 24-538 | Same as item 24-536, but 90 cm sweep. | Each | 1846 |
| | **Starters** | | |
| 24-539 | **Direct Online starter,** for motor, AC 400 V, 3 phase, 50 cycles, upto 5HP incl connecting up with incoming and outgoing cables, supply and fixing. | Each | 5745 |
| 24-540 | Same as item 24-539, but fixing only. | Each | 345 |
| 24-541 | Add to item 24-539 or 24-540, if removal only. | Each | 173 |
| 24-542 | **Auto Star Delta** starter, for electric motor, AC 400 V, 3 phase, 50 cycles, 7.5 to 10 HP, including connecting up with incoming and outgoing cables, supply and fixing. | Each | 40953 |
| 24-543 | Same as item 24-542 but for 15 HP. | Each | 42518 |
| 24-544 | Same as item 24-542, but for 20 HP. | Each | 44744 |
| 24-545 | Same as item 24-542 but for 25 HP. | Each | 47692 |
| . 24-546 | Same as item 24-542 but for 30 HP. | Each | 53589 |
| 24-547 | Same as item 24-542, but for 40 HP. | Each | 57897 |
| 24-548 | Same as item 26-503, but for 50 HP. | Each | 66742 |
| 24-549 | Same as item 24-542, but for 60 HP | Each | 71797 |
| 24-550 | Same as item 24-542, but for 80 HP | Each | 95805 |
| 24-551 | Same as item 24-542 but for 100 /125 HP. | Each | 127035 |
| 24-552 | Same as item 24-542 to 24-546, but fixing only. | Each | 518 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | Same as item 24-547 to 24-551, but fixing only. | Each | 1035 |
| | Add to item 24-542 to 24-551 or 24-552, 24-553, if removal only. | Each | 431 |
| | **Conduit System** | | |
| | **Bend/ elbow,** 20 mm dia, any type, cast or malleable iron, stove enamelled or galvanized, supply and fixing. | Each | 109 |
| | Same as item 24-555, but 25 mm dia. | Each | 129 |
| | Same as item 24-555, but 40 mm dia. | Each | 222 |
| | Same as item 24-555, but 50 mm dia. | Each | 278 |
| | **Junction Box circular,** cast or malleable iron, stove enamelled or galvanized, complete with cover, any number of outlets, 20 mm dia, supply and fixing. | Each | 118 |
| | Same as item 24-559, but 25 mm dia. | Each | 142 |
| | Same as item 24-559, but 40 mm dia. | Each | 250 |
| | Same as item 24-559, but 50 mm dia. | Each | 316 |
| | **Junction Boxes/Board,** rectangular 75x75 mm, cast or malleable iron, stove enamelled or galvanized, complete with cover, supply and fixing. | Each | 160 |
| | Same as item 24-563 but 75 x 100 mm. | Each | 184 |
| | Same as item 24-563 but 75 x 150 mm. | Each | 202 |
| | Same as item 24-563, but 100 x 175 mm. | Each | 202 |
| | Same as item 24-563, but 200 x 250 mm. | Each | 243 |
| | Same as item 24-563, but 250 x 300 mm. | Each | 261 |
| | Same as item 24-555 to 24-558, but fixing only. | Each | 52 |
| | Same as item 24-559 to 24-566, but fixing only. | Each | 52 |
| | Same as item 24-567 or 24-568, but fixing only. | Each | 69 |
| | Add to item 24-555 to 24-558 or 24-569, if removal only. | Each | 31 |
| | Add to item 24-559 to 24-566 or 24-570, if removal only. | Each | 31 |
| | Add to item 24-567 to 24-568 or 24-571, if removal only. | Each | 41 |
| | **Lock nut,** 12 mm dia, supply and fixing. | Each | 67 |
| | Same as item 24-575, but 20 mm dia. | Each | 82 |
| | Same as item 24-575, but 25 mm dia. | Each | 82 |
| | Same as item 24-575, but 30 mm dia. | Each | 94 |
| | **Tee inspection,** 20 mm dia, supply and fixing | Each | 106 |
| | Same as item 24-579, but 25 mm dia. | Each | 184 |
| | Same as item 24-579, but 40 mm dia. | Each | 316 |
| | Same as item 24-579, but 50 mm dia. | Each | 388 |
| | **Saddles,** 20 mm pressed steel system, supply and fixing. | Each | 94 |
| | Same as item 24-583, but 25 mm dia. | Each | 100 |
| | Same as item 24-583 but 40 mm dia. | Each | 138 |
| | Same as item 24-583, but 50 mm dia. | Each | 166 |
| | Same as item 24-575 to 24-586, but fixing only. | Each | 52 |
| | Add to item 24-575 to 24-586 or 24-587, if removal only. | Each | 35 |
| | **Thimble** cable socket, for single core cable, 6 $mm^2$, to 16 mm.2 supply and fixing. | Each | 91 |
| | Same as item 24-589, but for 25 $mm^2$ | Each | 97 |
| | Same as item 24-590, but for 35 mm | Each | 105 |
| | Same as item 24-591, but for 50 $mm^2$ | Each | 143 |
| | Same as item 24-591, but for 70 $mm^2$ | Each | 161 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-594 | Same as item 24-591, but for 95 $mm^2$ | Each | 230 |
| 24-595 | Same as item 24-591, but for 120 $mm^2$ | Each | 248 |
| 24-596 | Same as item 24-591, but for 150 $mm^2$ | Each | 361 |
| 24-597 | Same as item 24-591, but for 185 $mm^2$ | Each | 420 |
| 24-598 | Same as item 24-591, but for 240 $mm^2$ | Each | 612 |
| 24-599 | Same as item 24-591, but for 300 $mm^2$ | Each | 836 |
| *$2^{11}$t-600* | Same as item 24-589 to 24-591 but fixing only. | Each | 69 |
| 24-601 | Same as item 24-592 to 24-593 but fixing only. | Each | 86 |
| 24-602 | Same as item 24-594 to 24-595 but fixing only. | Each | 104 |
| 24-603 | Same as item 24-596 to 24-597 but fixing only. | Each | 121 |
| 24-604 | Same as item 24-598 to 24-599, but fixing only. | Each | 138 |
| 24-605 | Add to item 24-589 to 24-593 or 24-600, 24-601 if removal only. | Each | 35 |
| 24-606 | Add to item 24-594 to 24-595 or 24-602, if removal only. | Each | 52 |
| 24-607 | Add to item 24-596 to 24-597 or 24-603, if removal only. | Each | 62 |
| 24-608 | Add to item 24-598 to 24-599 or 24-604, if removal only. | Each | 69 |
| | **Wiring** | | |
| 24-609 | Wiring in conduit surface, concealed, flame proof, with single core PVC insulated cable, installed and connected complete (excluding conduit) single core cable, 1 $mm^2$, supply and fixing. | Metre | 46 |
| 24-610 | Same as item 24-609, but 1.5 $mm^2$ cable. | Metre | 58 |
| 24-611 | Same as item 24-609, but 2.5 $mm^2$ cable. | Metre | 78 |
| 24-612 | Same as item 24-609, but 4$mm^2$ cable. | Metre | 99 |
| 24-613 | Same as item 24-609, but 6 $mm^2$ cable. | Metre | 131 |
| 24-614 | Same as item 24-609, but 10 $mm^2$ cable. | Metre | 203 |
| 24-615 | Same as item 24-609, but 16$mm^2$ cable. | Metre | 289 |
| 24-616 | Same as item 24-609, but 25 $mm^2$ cable. | Metre | 442 |
| 24-617 | Same as item 24-609, but 35 $mm^2$ cable. | Metre | 575 |
| 24-618 | Same as item 24-609, but 50 $mm^2$ cable. | Metre | 773 |
| 24-619 | Same as item 24-609, but 70 $mm^2$ cable. | Metre | 1101 |
| 24-620 | Same as item 24-609 to 24-614, but fixing only. | Metre | 28 |
| 24-621 | Same as item 24-616 to 24-619, but fixing only. | Metre | 86 |
| 24-622 | Add to item 24-609 to 24-614 or 24-620, if removal only. | Metre | 14 |
| 24-623 | Add to item 24-616 to 24-619 or 24-621, if removal only. | Metre | 41 |
| | **Multi Core Cable** | | |
| 24-624 | Twin core cable 1 $mm^2$ copper conductor, PVC insulated cable complete (excluding conduit), supply and fixing. | Metre | 84 |
| 24-625 | Same as item 24-624, but 1.5 $mm^2$ | | 108 |
| 24-626 | Same as item 24-624, but 2.5 $mm^2$ | Metre | 143 |
| 24-627 | Same as item 24-624, but 4 $mm^2$ | Metre | 228 |
| 24-628 | Same as item 24-624, but 6 $mm^2$ | Metre | 261 |
| 24-629 | Same as item 24-624, but 10 $mm^2$ | Metre | 421 |
| 24-630 | Same as item 24-624 to 24-629, but fixing only. | Metre | 35 |
| 24-631 | Add to item 24-624 to 24-629 or 24-630, if removal only. | Metre | 17 |
| 24-632 | Cable 3 core 1 $mm^2$ copper conductor PVC insulated cable complete (excluding conduit), supply and fixing. | Metre | 126 |
| 24-633 | Same as item 24-632 but 1.5 mm | Metre | 165 |
| 24-634 | Same as item 24-632 but 2.5 $mm^2$ | Metre | 218 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-635 | Same as item 24-632 but 4 $mm^2$ | Metre | 303 |
| 24-636 | Same as item 24-632, but 6 $mm^2$ | Metre | 417 |
| 24-637 | Same as item 24-632, but 10 $mm^2$ | Metre | 666 |
| 24-638 | Same as item 24-632 to 24-637, but fixing only. | Metre | 35 |
| 24-639 | Add to item 24-632 to 24-637 or 24-639, if removal only. | Metre | 17 |
| 24-640 | Cable 4 core PVC insulated cable complete, (excluding of conduit) 1.5 $mm^2$. | Metre | 186 |
| 24-641 | Same as item 24-640 but 2.5 $mm^2$ | Metre | 285 |
| 24-642 | Same as item 24-640 but 4 $mm^2$ | Metre | 421 |
| 24-643 | Same as item 24-640 but 6 $mm^2$ | Metre | 539 |
| 24-644 | Same as item 24-640 but 10 $mm^2$ | Metre | 847 |
| 24-645 | Same as item 24-640 to 24-644, but fixing only. | Metre | 35 |
| 24-646 | Add to item 24-640 to 24-644 or 24-645, if removal only. | Metre | 17 |
| 24-647 | Flexible Cable Twin Core 300/500 V 23/0.0076. | Metre | 95 |
| 24-648 | Same as item 24-647 but, 40/0.0076. | Metre | 110 |
| 24-649 | Same as item 24-647 but, 70/0.0076. | Metre | 125 |
| 24-650 | Same as item 24-647 but, 110/0.0076 | Metre | 175 |
| 24-651 | Same as item 24-647 but, 162/0.0076 | Metre | 257 |
| 24-652 | Same as item 24-647 to 24-651, but fixing only. | Metre | 35 |
| 24-653 | Add to item 24-647 to 24-651 or 24-652, if removal only. | Metre | 17 |
| 2 654 | Flexible Cable 3 Core 300/500 V 23/0.0076 supply and fixing | Metre | 114 |
| 24-655 | Same as item 24-654 but k40/0.0076 | Metre | 138 |
| 24-656 | Same as item 24-654 but 70/0.0076 | Metre | 174 |
| 24-657 | Same as item 24-654 but 110/0.0076 | Metre | 224 |
| 24-658 | Same as item 24-654 but 162/0.0076 | Metre | 337 |
| 24-659 | Same as item 24-654 to 24-658, but fixing only. | Metre | 35 |
| 24-660 | Add to item 24-654 to 24-658 or 24-659, if removal only. | Metre | 17 |
| 24-661 | Flexible Cable 4 Core 300/500 V 23/0.0076 supply and fixing | Metre | 129 |
| 24-662 | Same as item 24-661 but 40/0.0076 | Metre | 155 |
| 24-663 | Same as item 24-661 but 70/0.0076 | Metre | 193 |
| 24-664 | Same as item 24-661 but 110/0.0076 | Metre | 291 |
| 24-665 | Same as item 24-661 but 162/0.0076 | Metre | 435 |
| 24-666 | Same as item 24-661 to 24-665, but fixing only. | Metre | 35 |
| 24-667 | Add to item 24-661 to 24-665 or 24-666, if removal only. | Metre | 17 |
| 24-668 | Telephone cable, 2 pairs copper conductor 0.6 mm dia, PE insulated, PVC sheathed, supply and fixing. | Metre | 58 |
| 24-669 | Same as item 24-668, but 3 pairs. | Metre | 76 |
| 24-670 | Same as item 24-668, but 4 pairs | Metre | 105 |
| 24-671 | Same as item 24-668, but 5 pairs. | Metre | 127 |
| 24-672 | Same as item 24-668 but 6 Pair | Metre | 143 |
| 24-673 | Same as item 24-668 but 8 Pair | Metre | 180 |
| 24-674 | Same as item 24-668 but 10 Pair | Metre | 218 |
| 24-675 | Same as item 24-668 to 24-674, but fixing only. | Metre | 35 |
| 24-676 | Add to item 24-668 to 24-674 or 24-675, if removal only. | Metre | 17 |
| 24-677 | Television Coaxial cable 0.8$mm^2$ SC, 2V, 75 ohm, RG 6 Supply & fixing. | Metre | 67 |
| 24-678 | Same as item 24-677 but RG 7 | Metre | 135 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-679 | Same as item 24-677 but RG 11 | Metre | 160 |
| 24-680 | Same as item 24-677 to 24-679, but fixing only. | Metre | 52 |
| 24-681 | Add to item 24-677 to 24-679 or 24-680, if removal only. | Metre | 35 |
| 24-682 | Step light Led, Aluminium die cast body, with grill and milky glass 220/240 V, 3 watt, complete, supply & fixing. | Metre | 2236 |
| 24-683 | Same as item 24-682, but fixing only. | Metre | 52 |
| 24-684 | Add to item 24-682 or 24-683, if removal only. | Metre | 35 |
| | **Exhaust Fan AC** | | |
| 24-685 | Fan electric, AC, **Exhaust, metal body with copper winding** 25 cm & 30 cm, 220/230 V, with shutter, Metal duly enamel painted, "Standard" supply and fixing. | Each | 3102 |
| 24-686 | Same as item 24-685 but Deluxe | Each | 3136 |
| 24-687 | Same as item 24-686 but Premium | Each | 3497 |
| 24-688 | Fan electric, AC, **Exhaust, metal body with copper winding** 40 cm & 45 cm, 220/230 V, with shutter, Metal enamel painted, "Standard" supply and fixing. | Each | 4619 |
| 24-689 | Same as item 24-688 but Deluxe | Each | 4724 |
| 24-690 | Same as item 24-688 but Premium | Each | 5084 |
| 24-691 | Fan electric, AC, **Exhaust, metal body with copper winding** 50 cm & 60 cm 220/230 V, with shutter, Metal enamel painted, "Standard" supply and fixing. | Each | 5606 |
| 24-692 | Same as item 24-691 but Deluxe | Each | 5704 |
| 24-693 | Same as item 24-691 but Premium | Each | 6165 |
| 24-694 | Same as item 24-685 to 24-690 but fixing only. | Each | 431 |
| 24-695 | Same as item 24-691 to 24-694, but fixing only. | Each | 518 |
| 24-696 | Add to item 24-685 to 24-694 or 24-695, if removal only. | Each | 242 |
| 24-697 | **Shutter Metal** for Exhaust fan any size, enamel painted, supply and fixing. | Each | 407 |
| 24-698 | Same as item 24-697, but fixing only. | Each | 35 |
| 24-699 | Add to item 24-697 or 24-698, if removal only. | Each | 25 |
| 24-700 | Fan electric, AC, **Exhaust, with copper winding,** 220/230 V, SP, single/double way, 50 cycle, having **plastic frame** body and blades, complete with cord operated switch, shutter and fixing screws 20 cm & 25 cm "Standard" supply and fixing. | Each | 3017 |
| 24-701 | Same as item 24-700 but Deluxe. | Each | 3143 |
| 24-702 | Same as item 24-700 but Premium. | Each | 3359 |
| 24-703 | Fan electric, AC, **Exhaust, with copper winding,** 220/230 V, SP, double way 50 cycle, having **plastic frame** body and blades, complete with cord operated switch, shutter and fixing screws, 30 cm "Standard" supply and fixing. | | 3378 |
| 24-704 | Same as item 24-703 but Deluxe. | Each | 3480 |
| 24-705 | Same as item 24-703 but Premium. | Each | 3810 |
| 24-706 | Fan electric, AC. **Exhaust with copper winding** fresh air circulation (single way), 220/230 V, SP, 50 cycle, having plastic frame, body and blades, complete with cord operated switch, shutter and fixing screw, 30 cm "Standard", supply and fixing. | Each | 2955 |
| 24-707 | Same as item 24-706, but "Deluxe". | Each | 3059 |
| 24-708 | Same as item 24-706, but "Premium". | Each | 3368 |
| 24-709 | Same as item 24-700 to 24-708, but fixing only. | Each | 443 |
| 24-710 | Add to item 24-700 to 24-708 or 24-709, if removal only. | Each | 114 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-711 | Fan electric, AC, Exhaust, with **copper winding, 30 cm, Flame proof,** 220/230 V, SP, complete, supply and fixing. | Each | 9664 |
| 24-712 | Same as item 24-711, but 45 cm. | Each | 18064 |
| 24-713 | Same as item 24-711, but 60 cm. | Each | 28864 |
| 24-714 | Same as item 24-711 to 24-713, but fixing only. | Each | 664 |
| 24-715 | Add to item 24-711 to 24-713 or 24-714, if removal only. | Each | 190 |
| | **Air Compressors** | | |
| 24-716 | Air compressor, single stage air cooled, mounted with horizontal receiving tan!<:: 300 lit capacity, max pressure **10 Kg/Cm2** (142 Psi), 3 cylinders, piston displacement 54.30 cfm, fitted with auto pressure switch, pressure gauge and AC electric motor 10 HP, 400 V, 3 phase, 50 cycles, supply and fixing. | Each | 194310 |
| 24-717 | Same as item 24-716 but tank capacity 250 lit, 2 cylinders, displacement 39.50 cfm, with 7.5 HP electric motor. | Each | 146310 |
| 24-718 | Same as item 24-716, but tank capacity 160 lit, 3 cylinders, displacement 26.50 cfm, with 5 HP electric motor. | Each | 116310 |
| 24-719 | Same as item 24-716, but tank capacity 120 lit, 2 cylinders, displacement 16.40 cfm, with 3 HP electric motor. | Each | 80310 |
| 24-720 | Same as item 24-716, but tank capacity 100 lit, 2 cylinders, displacement 10.60 cfm, with 2 HP electric motor. | Each | 76710 |
| 24-721 | Same as item 24-716, but tank capacity 90 lit, 2 cylinders, displacement 8.50 cfm, with 1 HP electric motor **single phase.** | Each | 51810 |
| 24-722 | Same as item 24-721, but tank capacity 60 lit, 2 cylinders, displacement 3.7 cfm, with 0.5 HP electric motor. | Each | 40710 |
| 24-723 | Same as item 24-721, but tank capacity 300 lit, pressure 16 Kg/Cm2 (228 Psi) 3 cylinders, piston displacement 38.50 cfm with 10 HP electric motor. | Each | 170310 |
| 24-724 | Same as item 24-723, but tank capacity 300 lit, 2 cylinders, displacement 26.30 cfm, 7.5 HP, Electric motor. | Each | 170310 |
| 24-725 | Same as item 24-724, but tank capacity 160 lit, 2 cylinders, displacement 20.40 cfm, 5 HP, Electric motor. | Each | 116310 |
| 24-726 | Same as item 24-716 to 24-725, but fixing only. | Each | 2310 |
| 24-727 | Add to item 24-716 to 24-725 or 24-726, if removal only. | Each | 923 |
| | **Pumping Set For Fuels** | | |
| 24-728 | Pumping set, Centrifugal, multistage, for fuel, CI body and impeller, stainless steel shaft and mechanical seal, capacity 300 gpm, 48.75M head, directly coupled with explosion proof AC electric motor, 400 V, 3 phase, 50 cycles, 20 HP, mounted on common base steel frame, with foundation bolts/nuts, supply and fixing. | Each | 1719240 |
| 24-729 | Same as item 24-728, but capacity 300 gpm, 43 M head, with electric motor, 3 Phase, 20 HP. | Each | 1546320 |
| 24-730 | Same as item 24-728, but capacity 200 gpm, 57 M head, with electric motor, 3 Phase, 20 HP. | Each | 1546320 |
| 24-731 | Same as item 24-730, but capacity 200 gpm, 49 M head, with electric motor, 3 Phase, 15 HP. | Each | 1304490 |
| 24-732 | Same as item 24-731, but capacity 200 gpm, 36 M head, with mot9r electric motor, 3 Phase, 10 HP. | Each | 987030 |
| 24-733 | Same as item 24-728 to 24-730, but fixing only. | Each | 3240 |
| 24-734 | Same as item 24-731 to 24-732, but fixing only. | Each | 2310 |
| 24-735 | Add to item 24-679 to 24-728 or 24-733, if removal only. | Each | 1620 |
| 24-736 | Add to item 24-682 to 24-731 or 24-734, if removal only. | Each | 1155 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Electric Geyser** | | |
| 24-737 | Electric Geyser, 27 lit capacity, complete with thermostat, safety valve, supply and fixing. | Each | 11955 |
| 24-738 | Same as item 24-737, but 36 lit capacity. | Each | 12138 |
| 24-739 | Same as item 24-737, but 45 lit capacity. | Each | 13242 |
| 24-740 | Same as item 24-733 to 24-739, but fixing only. | Each | 915 |
| 24-741 | Add to item 24-735 to 24-739 or 24-740, if removal only. | Each | 686 |
| 24-742 | Instant Electric Water Geyser, capacity 6 lit/min, complete supply & fixing. | Each | 12195 |
| 24-743 | Same as item 24-742 but 8 liters. | Each | 15075 |
| 24-744 | Same as item 24-742 but 10 liters. | Each | 15315 |
| 24-745 | Same as item 24-742 to 24-744 but fixing only. | Each | 915 |
| 24-746 | Add to item 24-742 to 24-744 or 24-745 if removal only. | Each | 630 |
| 24-747 | **Distribution Board,** steel sheet (16 BG) with hinged over, having locking arrangement, enamel painted, suitable for housing of different capacities of MCCBs etc (as required), supply and fixing. | Sqm | 28118 |
| 24-748 | Same as item 24-747, but fixing only. | Sqm | 518 |
| 24-749 | Add to item 24-747 or 24-748, if removal only. | Sqm | 345 |
| | **Wiring in PVC Channels** | | |
| 24-750 | PVC channel rectangular, 20 mm complete for (surface wiring), supply and fixing. | Metre | 192 |
| 24-751 | Same as item 24-750, but 25 mm. | Metre | 287 |
| 24-752 | Same as item 24-750 but 40 mm | Metre | 352 |
| 24-753 | Same as item 24-750, but 50 mm. | Metre | 520 |
| 24-754 | Same as item 24-750, but 65 mm. | Metre | 610 |
| 24-755 | Same as item 24-750, but 75 mm. | Metre | 697 |
| 24-756 | Same as item 24-750, but 100 mm. | Metre | 925 |
| 24-757 | Same as item 24-750 to 24-753 but fixing only. | Metre | 86 |
| 24-758 | Same as item 24-754 to 24-756 but fixing only. | Metre | 173 |
| 24-759 | Add to item 24-750 to 24-756 or 24-757, 24-758 if removal only. | Metre | 69 |
| | **Gang Switch Series (Standard)** | | |
| 24-760 | One gang switch, 10 A, 250 V, including PVC/steel back box with proper screws supply and fixing. | Each | 338 |
| 24-761 | Same as item 24-760, but 2 gang, 10 A. | Each | 454 |
| 24-762 | Same as item 24-761, but 3 gang, 10 A. | Each | 535 |
| 24-763 | Same as item 24-762, but 4 gang, 10 A. | Each | 614 |
| 24-764 | Same as item 24-763, but 6 gang, 10 A. | Each | 835 |
| 24-765 | Same as item 24-764, but 8 gang, 10 A. | Each | 1087 |
| 24-766 | One gang switch, 2 way 10 A, 250 V, including PVC/steel back box with proper screws supply and fixing. | Each | 404 |
| 24-767 | Gang fan dimmer 10 A, 250 V, including PVC/steel back box with proper screws supply and fixing. | Each | 336 |
| 24-768 | Gang TV/ Telephone socket, shuttered, including PVC/steel back box with proper screws supply and fixing. | Each | 470 |
| 24-769 | Twin TV/ Telephone socket, shuttered, including PVC/steel back box with proper screws supply and fixing. | Each | 525 |
| 24-770 | Single switch, one way, 10 A, 250 V gang type, including PVC/steel back box with proper screws supply and fixing. | Each | 217 |
| 24-771 | Same as item 24-770, but 2 ways, 10 A. | Each | 315 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-772 | **Bell** push, single switch 10 A, 250 V, gang type, including PVC/steel back box with proper screws supply and fixing. | Each | 441 |
| 24-773 | One socket 2 pin 10 A, 250 V, gang type, including PVC/steel back box with proper screws supply and fixing. | Each | 378 |
| 24-774 | Dimmer for fan 250 V, including PVC/steel back box with proper screws supply and fixing | Each | 217 |
| 24-775 | **TV / Telephone socket** (gang type), including PVC/steel back box with proper screws supply and fixing. | Each | 464 |
| 24-776 | Ten gang switch 10 A 250 volts Complete, including PVC/steel back box with proper screws Supply & fixing | Each | 1207 |
| 24-777 | Same as item 24-776, but, 9 Switch +1 socket | Each | 1133 |
| 24-778 | Same as item 24-776, but 8 Switch +2 socket | Each | 1133 |
| 24-779 | Same as item 24-776, but 7 Switch +1 socket | Each | 1016 |
| 24-780 | Same as item 24-776, but, 6 Switch +2 socket | Each | 1016 |
| 24-781 | Same as item 24-776, but 5 Switch +1 socket | Each | 905 |
| 24-782 | Same as item 24-776, but 4 Switch +2 socket | Each | 905 |
| 24-783 | Same as item 24-776, but 3 Switch +3 socket | Each | 1010 |
| 24-784 | Same as item 24-776, but 4 Switch +4 socket | Each | 1150 |
| 24-785 | Same as item 24-776, but 1 Switch +1 socket | Each | 565 |
| 24-786 | Same as item 24-776, but 2 Switch +1 socket | Each | 551 |
| 24-787 | Same as item 24-776, but 1 Switch +2 socket | Each | 649 |
| 24-788 | Same as item 24-776, but 2 Switch +2 socket | Each | 649 |
| 24-789 | Same as item 24-776, but 3 Switch +1 socket | Each | 649 |
| 24-790 | Same as item 24-760 to 24-789, but fixing only. | Each | 173 |
| 24-791 | Add to item 24-760 to 24-789 or 24-790, if removal only. | Each | 104 |
| 24-792 | Multi socket Light Plug, 10A, 250 V including PVC/ steel back box with proper screws Complete, supply and fixing. | Each | 693 |
| 24-793 | Gang Power Socket, 15A, 250 V including PVC/steel back box with proper screws complete, supply & fixing. | Each | 594 |
| 24-794 | Gang Single Telephone Socket Complete, including PVC/steel back box with proper screws supply & fixing. | Each | 468 |
| 24-795 | Gang Double Telephone Socket Complete, including PVC/steel back box with proper screws, supply & fixing. | Each | 474 |
| 24-796 | Gang Single TV Socket Complete, including PVC/steel back box with proper screws, supply & fixing. | Each | 489 |
| 24-797 | Gang Double TV Socket Complete, including PVC/steel back box with proper screws supply & fixing. | Each | 594 |
| 24-798 | Gang Switch 2-pole 20 A, 250 V, Complete, including PVC/steel back box with proper screws supply & fixing. | Each | 672 |
| 24-799 | Same as item 24-792 to 24-799, but fixing only. | Each | 104 |
| 24-800 | Add to item 24-792 to 24-790 or 24-799, if removal only. | Each | 69 |
| | **Gang Switch Series Premium** | | |
| 24-801 | One gang switch, 1OA, 250 V, complete, including PVC/steel back box with proper screws, supply & fixing. | Each | 320 |
| 24-802 | Same as item 24-801, but Two gang switch. | Each | 450 |
| 24-803 | Same as item 24-801, but Three gang switch. | Each | 668 |
| 24-804 | Same as item 24-801, but Four gang switch. | Each | 1064 |
| 24-805 | Same as item 24-801, but Five gang switch. | Each | 1262 |
| 24-806 | Same as item 24-801, but Six gang switch. | Each | 1305 |
| 24-807 | Same as item 24-801, but Eight gang switch. | Each | 1500 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-808 | Same as item 24-801, but One gang switch 2 way, 10 A, 250 V. | Each | 424 |
| 24-809 | Same as item 24-801, but One gang Bell switch. | Each | 502 |
| 24-810 | Same as item 24-801 to 24-809, but fixing only. | Each | 119 |
| 24-811 | Add to item 24-801 to 24-809 or 24-810, if removal only. | Each | 104 |
| 24-812 | Gang Telephone socket shuttered, including PVC/steel back box with proper screws complete, supply & fixing. | Each | 594 |
| 24-813 | Gang TV socket shuttered, including PVC/steel back box with proper screws complete, supply fixing. | Each | 560 |
| 24-814 | Gang Twin TV/ Telephone socket shuttered, including PVC/steel back box with proper screws complete, supply & fixing. | Each | 885 |
| 24-815 | Gang One gang switch + One Socket including PVC/steel back box with proper screws complete, supply & fixing. | Each | 711 |
| 24-816 | Same as item 24-815, but Two gang switch + One Socket | Each | 1103 |
| 24-817 | Same as item 24-815, Three gang switch + One Socket | Each | 1190 |
| 24-818 | Same as item 24-815, Four gang switch + One Socket | Each | 1388 |
| 24-819 | Same as item 24-815, Five gang switch + One Socket | Each | 1718 |
| 24-820 | Same as item 24-815, Six gang switch + One Socket | Each | 1849 |
| 24-821 | Same as item 24-815, One gang switch + One Dimmer | Each | 1234 |
| 24-822 | Same as item 24-815, Two gang switch + One Dimmer | Each | 1364 |
| 24-823 | Same as item 24-815, Three gang switch + One Dimmer | Each | 1691 |
| 24-824 | Same as item 24-815, Four gang switch+ One Dimmer | Each | 1867 |
| 24-825 | Same as item 24-815, Six gang switch+ One Dimmer | Each | 2066 |
| 24-826 | Same as item 24-815, Three gang Switch + one Dimmer + One Socket | Each | 2197 |
| 24-827 | Same as item 24-815, 5 Step Fan speed controller including PVC/ steel back box with proper screws. | Each | 1169 |
| 24-828 | Same as item 24-815, Fan speed controller with Switch. | Each | 1082 |
| 24-829 | Same as item 24-815, 5 Amp 3 Pin Switch Multi Socket. | Each | 690 |
| 24-830 | Same as item 24-815, 10 Amp 3 Pin Switch Socket. | Each | 537 |
| 24-831 | Same as item 24-815, 15 Amp 3 Pin Switch Socket. | Each | 624 |
| 24-832 | Same as item 24-815, 20 Amp 3 Pin Switch Socket. | Each | 650 |
| 24-833 | Same as item 24-812 to 24-832, but fixing only. | Each | 173 |
| 24-834 | Add to item 24-812 to 24-832 or 24-833, if removal only. | Each | 104 |
| 24-835 | **Lawn / Garden light,** complete with 23W, LED Bulb, plastic cover and mounting bracket (without pipe post), supply and fixing. | Each | 6945 |
| 24-836 | Same as item 24-835, but fixing only | Each | 345 |
| 24-837 | Add to item 24-835or 24-836, if removal only. | Each | 173 |
| 24-838 | **Wall Bracket,** fancy, single, complete with holder and lamp, supply and fixing. | Each | 2229 |
| 24-839 | Same as item 24-838, but Double. | Each | 2709 |
| 24-840 | **Porch light,** fancy, complete with holder and lamp, supply and fixing. | Each | 1509 |
| 24-841 | **Gate light,** fancy, complete with holder and lamp of approved type, supply and fixing. | Each | 2941 |
| 24-842 | Same as item 24-840 to 24-841, but fixing only. | Each | 69 |
| 24-843 | Add to item 24-840 to 24-841 or 24-842, if removal only. | Each | 52 |
| 24-844 | **Obstruction light,** with **Red glass,** holder, bracket, lamp and rod etc complete, supply and fixing. | Each | 6213 |
| 24-845 | Same as item 24-844, but fixing only. | Each | 345 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-846 | Add to item 24-844 or 24-845, if removal only. | Each | 259 |
| 24-847 | Phase Sequence Relay for electric motor, 3 Phase, 50 Cycles supply and fixing. | Each | 10590 |
| 24-848 | Same as item 24-847 but fixing only. | Each | 690 |
| 24-849 | Add to item 24-847 or 24-848 if removal only. | Each | 345 |
| 24-850 | Digital Ampere meter 600 A for LT panel, CT Operated supply & fixing | Each | 7269 |
| 24-851 | Analog Ampere meter 600 A for LT panel, CT Operated supply & fixing | Each | 2469 |
| 24-852 | Digital Volt meter 220/440 V for LT panel, CT Operated with selector switch, supply & fixing | Each | 6669 |
| 24-853 | Analog Volt meter 220/440 V for LT panel, CT Operated with Selector switch, supply & fixing | Each | 2469 |
| 24-854 | Same as item 24-850 to 24-853, but fixing only. | Each | 69 |
| 24-855 | Add to item 24-850 to 24-853 or 24-854, if removal only. | Each | 35 |
| 24-856 | Exit Light LED Complete with steel sheet powder coated, suitable operation on single phase with lithium battery for 12 hours back up, supply & Fixing. | Each | 9208 |
| 24-857 | Same as item 24-856, but fixing only. | Each | 80 |
| 24-858 | Add to item 24-856 or 24-857, if removal only. | Each | 35 |
| | **Magnetic Contactor 4 Pole** | | |
| 24-859 | Magnetic Contactor operational Current 40 to 60 Amps 3 phase, 4 pole, 440 volts, complete approved type, supply and fixing | Each | 9143 |
| 24-860 | Same as item 24-859 but, 50 to 80 Amps | Each | 13432 |
| 24-861 | Same as item 24-859 but, 65 to 100 Amps | Each | 17358 |
| 24-862 | Same as item 24-859 but 75 to 110 Amps | Each | 21234 |
| 24-863 | Same as item 24-859 but 85 to 135 Amps | Each | 22518 |
| 24-864 | Same as item 24-859 but 100 to 150 Amps | Each | 37638 |
| 24-865. | Same as item 24-859 but 130 to 150 Amps | Each | 44779 |
| 24-866 | Same as item 24-859 but 150 to 200 Amps | Each | 53438 |
| 24-867 | Same as item 24-859 but 185 to 230 Amps | Each | 57697 |
| 24-868 | Same as item 24-859 but 225 to 260 Amps | Each | 68312 |
| 24-869 | Same as item 24-859 but 265 to 300 Amps | Each | 109235 |
| 24-870- | Same as item 24-859 to 24-864, but fixing only. | Each | 259 |
| 24-871 | Same as item 24-865 to 24-869, but fixing only. | Each | 345 |
| 24-872 | Add to item 24-859to 24-864 or 24-870, if removal only. | Each | 138 |
| 24-873 | Add to item 24-865 to 24-869 or 24-871, if removal only. | Each | 276 |
| | **Magnetic Contactor 3 Pole** | | |
| 24-874 | Magnetic Contactor, operational Current 9 to 20 Amps, 3 phase, 440 volts, 3 pole, complete approved type, supply and fixing. | Each | 2062 |
| 24-875 | Same as item 24-874 but 12 to 20 Amps | Each | 2146 |
| 24-876 | Same as item 24-874 but, 18 to 25 Amps | Each | 2776 |
| 24-877 | Same as item 24-874 but, 22 to 32 Amps | Each | 3700 |
| 24-878 | Same as item 24-874 but, 32 to 50 Amps | Each | 5128 |
| 24-879 | Same as item 24-874 but, 40-to 60 Amps | Each | 6808 |
| 24-880 | Same as item 24-874 but, 50 to 80 Amps | Each | 9428 |
| 24-881 | Same as item 24-874 but, 65 to 100 Amps | Each | 10772 |
| 24-882 | Same as item 24-874 but, 75 to 11O Amps | Each | 12438 |
| 24-883 | Same as item 24-874 but, 85 to 135 Amps | Each | 14118 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 24-884 | Same as item 24-874 but, 100 to 150 Amps | Each | 19158 |
| 24-885 | Same as item 24-874 but, 130 to 150 Amps | Each | 23025 |
| 24-886 | Same as item 24-874 but, 150 to 200 Amps | Each | 29918 |
| 24-887 | Same as item 24-874 but, 185 to 230 Amps | Each | 37724 |
| 24-888 | Same as item 24-874 but, 225 to 260 Amps | Each | 45705 |
| 24-889 | Same as item 24-874 but, 265 to 300 Amps | Each | 60825 |
| 24-890 | Same as item 24-874 to 24-880 but fixing only. | Each | 173 |
| 24-891 | Same as item 24-881 to 24-885 but fixing only. | Each | 259 |
| 24-892 | Same as item 24-886 to 24-889 but fixing only. | Each | 345 |
| 24-893 | Add to item 24-874 to 24-880 or 24-890, if removal only. | Each | 138 |
| 24-894 | Add to item 24-881 to 24-885 or 24-891, if removal only. | Each | 207 |
| 24-895 | Add to item 24-886 to 24-889 or 24-892, if removal only. | Each | 276 |

# SECTION-25

# EXTERNAL ELECTRIFICATION

# RECORD OF **AMENDMENTS**

| Sl No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-25

# EXTERNAL ELECTRIFICATION

## SPECIFICATIONS

**25.0.** This Section covers Electrical distribution and transmission system; Low, Medium and High Pressures.

**25.1. Standard Requirement.** All external works shall be executed in accordance with the Electricity Regulations, Govt of Pakistan and Pakistan Standard Specifications, here-in after referred to as "Rules" except where such "Rules" are modified by these specifications.

**25.2. Equipment.** All the equipments/ materials shall comply with the relevant and latest BSS or equivalent Pakistan standard specification (PSS) and latest WAPDA standard / specification i.e. Transformers, Vacuum Circuit Breakers (VCBs), Air Circuit Breakers {ACBs), Automatic Voltage Regulators (AVRs) and Frequency Converter etc. shall be of approved manufacturers and booking orders placed through the Department. The delivery shall be ensured in the presence of authorised representative of the Department.

25.2.1. **Power Transformers.** All transformers indoor/ outdoor and pad mounted, shall be of approved manufacturers according to latest standard specifications as under:-

| | | | |
|---|---|---|---|
| (1) | Primary voltage 11000 V with the taping | - | ± 2.5%<br>±5.0%<br>±7.5% |
| (2) | No of phases | | 3 phase, 4 wire, with star delta connection |
| (3) | Over loading | | As per manufacturer's standards |
| (4) | Secondary Voltage | | 400 / 230 V, 3 phase 4 wires, 0.9 PF |

25.2.2. **Types of Transformers**

25.2.2.1 **Dry Type Transformers.** These are of following types:-

(1) Open Wound.
(2) Cast Resin.
(3) Vacuum Pressure Impregnated.
(4) Vacuum Pressure Encapsulated.

25.2.2.2. **Standard Specification.** As given below:-

(1) **Climatic Class** Class C1, C2, C3, C4.
(2) **Fire Behaviour class** Class F0, Class F1.
(3) **Cooling method** Air Natural ( AN), Air forced (AF).
(4) **Insulation class** Class A, E, B, F, H.
(5) **Environment Class** Class E0, E1, E2, E3, E4.
(6) **Ingress protection** IP00, IP21, IP23, IP31, IP33, IP45, IP56.

25.2.2.3 **Liquid filled transformer**

25.2.3 **Standard Fittings**

(1) Filling arrangement.
(2) Drain plug (Drain valve for capacities above 200 KVA).
(3) Oil level indicator.
(4) Lifting lugs.
(5) Rollers.
(6) HV Porcelain bushings.
(7) LV Porcelain bushings.
(8) Five position off circuit tap changer.
(9) Earthling terminal.
(10) Rating plate and name plate.
(11) Conservator and silica gel breather (with conservator type).

25.2.4. **Windings.** Paper insulated high conductivity copper be used for all LV windings and for HV winding of transformers above 300 KVA capacity. HV windings of smaller transformers be made from Double Enamelled High Conductivity copper wire. In distribution transformers, packet windings are used on HV side, which increases the short circuit withstand capacity.

25.2.5. **Core.** Transformer cores be manufactured with high quality cold rolled silicon steel sheets.

25.2.6. **Tank.** Tanks be made of deeply corrugated sidewalls. Alternatively these can be of the tubular type. All tanks are pressure tested before assembly.

25.2.7. **HT/ LT Bushing.** The transformer are generally equipped with three HV and four LV insulator Bushing on primary and secondary side respectively for three phase transformer. Where primary windings connection are connected on the high-tension side while 3 secondary windings are connected on low voltage side and fourth one is used for neutral. (Relevant Standards, DIN 7724, ASTM 1170, DDS-49:2009).

25.2.7.1. **Chemical Section**

| | | |
|---|---|---|
| (1) | Thickness of Tin Coating | 0.030 mm (Minimum) |
| (2) | Season Cracking | No Crack |
| (3) | Change in Mass | -5% to +15% |
| (4) | Chemical Composition | |
| | (a) Copper= 72% Minimum | |
| | (b) Tin = 1.0% Maximum | |
| | (c) Lead 3 % Maximum | |
| | (d) Zinc= Rest | |

25.2.7.2. **Mechanical Section (Pull out Force Test)**

| Sr. No. | Description of Material | Pull out Force (Kg) |
|---|---|---|
| (1) | HT Connector | 60 |
| (2) | LT Connector | 105 |

25.2.7.3. **Electrical section**

| | | |
|---|---|---|
| (1) | Temperature Rise Test | 25° C (Max) |
| (2) | Heat Cycle Test. | 05° C (Max) |

25.2.8. **Tap Changer.** The off circuit tap changer is built in with a vertical shaft and has five operating positions. Deviations from this design can be supplied on special order. (WAPDA Specs, DDS-84:2007).

25.2.8.1. **Transformer Turn Ratio Measurement**

| TAPE POSITION(VOLTAGE) | TURN RATIO | TOLERANCE (+ 5 %) |
|---|---|---|
| 1= 11275/(415/ 3) | 47.058 | 46.822 - 47.293 |
| 2= 11000/(415/ 3) | 45.910 | 45.680 - 46.140 |
| 3= 10725/(415/ 3) | 44.762 | 44.538 - 44.986 |
| 4= 10450/(415/ 3) | 43.614 | 43.396 - 43.832 |
| 5= 10175/(415/ 3) | 42.467 | 42.255 - 42.679 |

25.2.8.2. **Transformer Losses Measurement at 75 C (PRINCIPAL TAP) as per WAPDA Standards**

| Rating (KVA) | 5 | 10 | 15 | 25 | 50 | 100 | 200 | 400 | 630 |
|---|---|---|---|---|---|---|---|---|---|
| Iron Losses (Watts) | 44 | 52 | 68 | 98 | 140 | 248 | 396 | 740 | 1080 |
| Copper Losses (Watts) | 140 | 256 | 348 | 512 | 936 | 1616 | 2728 | 4480 | 6520 |

**Note:**

(1) The above guaranteed losses are maximum allowable and there would be no positive tolerance for both prototype and mass production.
(2) % Z=4, tolerance+ 10 % on principal tape and+ 15 % on any other taping.
(3) No-load current = 30 % of declared value.
(4) Limits of temperature rise: winding = 50° C and oil 40° C (for both prototype and mass production).

25.2.9. **Oil Level Gauge.** The Oil Level Gauge is fitted on the oil conservator and permits direct observation of its contents through a transparent plastic tube. On sealed type transformer, this is fitted on the side well above the corrugations or tubes.

25..2.10. **Roller Wheels.** The transformers are carried on flat-rimmed roller wheels. The axes are easily set over for either broadside or length wise travel of the wheels (centre distance remaining the same).

25.2.11. **Earthing Terminal.** Each Transformer is provided with an Earthing Terminal.

25.2.12. **Oil Draining Point.** :rhere is an oil-draining point at the bottom of transformer tank from where oil can be drained out. The vent is plugged by a screw cap, which makes it possible to take out even very small quantities for sample testing.

25.2.13. **Transformer Oil.** The Transformer is supplied with a first filling with mineral oil and has an impedance of 4% upto 500 KVA and 5% for 630-1500 KVA at 75° Cat high di-electric strength duly tested and treated. WAPDA Specs, DDS-84:2007).

25.2.13.1 **Specified Limits for Oil**

| | | |
|---|---|---|
| (1) | Flash Point | 140° C (Minimum) |
| (2) | Total Acidity | 0.03 mg of KOH/g of sample (Maximum) |
| (3) | Kinematic Viscosity | 40 est (Maximum) at 20° C |
| (4) | Moisture | Absent |
| (5) | Specific Gravity | 0.895 (Maximum) at 20° C |
| (6) | Pour Point | < -15° C |
| (7) | Dielectric Strength | 30 kV Minimum |

25.2.14. **HT Switchgear with VCB**

25.2.14.1. 11 KV Switchgear with VCB shall have the following specification and accessories:-

| Ser | Description | Rating |
|---|---|---|
| (1) | Vacuum Circuit Breaker, 25 KVA, 17.5 KV Sping Charging Motor 220 V, AC (85%-110%), 50ms DC closing Coil 110DVDC (85%-110%), 50ms DC Trip Coil 110 V, DC (70%-110%). | 630 ATP |
| (2) | Current Transformer 11 mKV, Bil 95 KV, 15 KVA, 25KA (For Metering & Protection). | 400/5/5 Amp |
| (3) | Potential Transformer 11 KV, Bil b95 KV, 100 VA Class 0.5%. | 11000/110 V |
| (4) | E/F, O/C, S/C, Relay Digital. | DP-34 |
| (5) | Energy Meter | 3-Phase (MDI) |
| (6) | Synchrocheck Relay | 3-Phase |
| (7) | Synchyroscope | 3-Phase |
| (8) | Dual Frequency Meter Analogue (96 x 96) | 50/60Hz |
| (9) | Ampere Meter Analogue (96 x 96) | 400/5 Amp |
| (10) | Ampere Selector Switch | 4-Positions |
| (11) | Dual Volt Meter Analogue (96 x 96) | 11000/110 V |
| (12) | Volt Selector Switch | 4-Positions |
| (13) | Capacitor Trip Unit with Voltage Storage Capacity | 110 Vac/dc |
| (14) | Terminal Block | 6 mm |
| (15) | Terminal Block | 4 mm |
| (16) | Insulator Resin Cost Height | 157 mm |
| (17) | Charging Handle, Racking Handle, Racking Plate | 11 KV |
| (18) | Push Button ON/OFF | |

**25.2.14.2.** The HT switchgear panel shall be of steel sheets totally enclosed indoor floor mounting cubicle type and shall have the accessories, such as with suitable CTs, PTs, and all other standard accessories with VCB. The VCB should be withdraw able type with full complement of interlocks to prevent incorrect operation and should be motor operated with an over ride of manual operation, in case the motor operation fails and cable boxes for incoming/outgoing cables as per latest WAPDA standard specification of approved make by E-in-C Branch.

25.2.14.3. Two direct acting release coils, one direct acting earth fault release coil to work in conjunction with triple pole inverse time projecting pattern. over current and Earth fault relay.

25.2.15. **LT Switch Panels.** These shall be of steel sheet (3 mm thick), totally enclosed, floor mounting, indoor type, suitable for operation on 3 Phases, 4 wires, 50 cycles, 400-600 V system and shall comprise of:-

(1) **Incoming**

(a) Triple Pole, 25 mva breaking Capacity at 500 V fixed type moulded case circuit breaker with manually operated quick breaking operation mechanism.

(b) Three adjustable thermal over current releases, three adjustable magnetic short circuit releases, arc chambers and one shunt trip coil.

(c) Three CTs with required ratio for tile operation of instruments one flush pattern voltmeter of instruments, one flush pattern voltmeter (0-600 V) with selector switch, one flush pattern ammeter of required capacity one earth fault relay single pole type, complete with indoor/outdoor cable termination or cable boxes as required.

(2) **Outgoing.** Load break, load make *50* V, Triple Pole solid neutral MCB of required capacity.

**25.3. Materials**

25.3.1. **Line Conductor.** Conductor shall be of copper, either solid hard drawn or stranded or of aluminum stranded and shall comply with Latest BSS or equivalent Pakistan standard specification (PSS).

25.3.2. **Poles or Supports.** Poles and supports shall be of iron/steel as per WAPDA's design.

25.3.3. **Stays and Stay Wires**

25.3.3.1 Stay assembly shall be of GI complying with BS-16 or equivalent PSS.

25.3.3.2. Stay wires shall be of GI/Steel stranded wire complying with BS-183 or equivalent PSS.

25.3.4. **Cross Arms and Clamps**

25.3.4.1. Cross arms shall be galvanized channel iron or creosoted wood for distribution and transmission line.

25.3.4.2. Clamps shall be of GI flats bars of approved size. MS black channel or flats may be used in lieu of GI with prior approval of the Engineer-in-Charge.

25.3.5. **Bolts, Nuts and Washers.** All bolts, nuts and washers shall be of GI with prior approved size, shape and strength. MS black bolts, nuts and washers may be used in lieu of GI with prior approval of the Engineer-in-Charge.

25.3.5.1. **PG Clamps.** PG clamps are also known as non-tension (bolted) connectors or parallel groove and are primarily used for the no-load connection/disconnection of aluminium/copper/ galvanized steel conductor combinations. PG clamps are for use on overhead electricity distribution networks in a totally exposed environment.

25.3.6. **Insulators.** Insulators shall be of glazed porcelain with mechanical strength to carry the loads and shall comply with the latest BS Specification P-6:76, P-4, IEC: 60137 standards.

25.3.6.1 **Chemical Section**

| | |
|---|---|
| Porosity Test | No Dye Impregnated |

25.3.6.2 **Mechanical Section**

| | |
|---|---|
| Mechanical load Test: | 1000 kg. |

25.3.6.3 **Electrical Section**

| | |
|---|---|
| (1) Dry Withstand Voltage Test | 23 kV For One minute |
| (2) Dry Flash Over Voltage Test | 25 kV (Minimum) |
| (3) Wet Withstand Voltage Test | 13 kV For One minute |
| (4) Wet Flash Over Voltage Test | 15 kV (Minimum) |
| (5) Puncture Voltage Test | 33 kV(Minimum) |

25.3.7. **Cables HT/LT**

25.3.7.1. **HT Cables** shall be of the following types:-

(1) PVC insulated, PVC sheathed, armoured with stranded aluminium/copper conductor according to latest Pakistan standard specifications.

(2) Three cores, Cross-Linked Polyethylene Insulated, (XLPE) compacted stranded copper / aluminium conductors, extruded semi conducting screened cable. The cable shall be of 11 KV grade. The cores being screened by semi conducting material, semi conducting taped and copper taped cores, laid up with filler to make circular shape and wrapped with binder Melinex taped extruded PVC bedded, armoured and over all PVC sheathed all as per I.E.C 502.

25.3.7.1.1 **Chemical Section (P-100:05)**

| | | |
|---|---|---|
| (1) | Heat Shock Test | No Crack |
| (2) | Heat Distortion Test | 50% Maximum |
| (3) | Resistance to Burning | Self Extinguishing |
| (4) | Loss Mass | - 2 mg/cm$^2$ Maximum 2mg/ cm$^2$ Max |
| (5) | Colour Fastness Test | No Coloration |
| (6) | Water absorption Test | 1.5mg/cm2 Maximum |
| (7) | Shrinkage Test | 4% max |

25.3.7.1.2 **Electrical Section**

| | | |
|---|---|---|
| (1) | D.C Resistance Test at 20°C, 35m$^2$ | - 0.8680 .0/km (Maximum) |
| (2) | D.C Resistance Test at 20°C, 120m$^2$ | - 0.2530 .0/km (Maximum) |
| (3) | D.C Resistance Test at 20°c, 240m$^2$ | - 0.1250 .0/km (Maximum) |
| (4) | D.C Resistance Test at 20°C, 500m$^2$ | - 0.0605 .0/km (Maximum) |
| (5) | D.C Resistance at 20°c, 35 m$^2$ (Copper Screen) | - 1.15 .0/km (Max) |
| (6) | D.C Resistance at 20°C, 120 mm$^2$ (Copper Screen) | - 1.15 .0/km (Max) |

(7) D.C Resistance at 20°C, 240 $mm^2$ (Copper Screen) - 0.727 0/km (Max)

(8) D.C Resistance at 20°C, 500 $mm^2$ (Copper Screen) - 0.524 0/km (Max)

25.3.7.2. **LT Cables**

25.3.7.2.1. PVC insulated PVC sheathed SWA and PVC overall, 600/1000 V grade multi core cable according to latest Pakistan standard specifications with:-

(1) Stranded Copper conductors.

(2) Stranded Aluminium conductors.

25.3.7.2.2. PVC insulted PVC sheathed unarmoured, 600/1000 V, grade with stranded copper conductors, multi core cables according to latest Pakistan standard specifications.

25.3.8. **Cable Boxes.** All other accessories shall be of approved type and design conforming to the latest BS and shall be approved by the Engineer-in- Charge before erection/installation.

## 25.4. Earth for Transformer, HT/LT Switchgear

25.4.1. Excavation for the earth pipe shall be done to a depth of 4.60 M in any type of soil and shall not be less than **2 M** from the nearest foundation of the building.

25.4.2. 4 M long and 50 mm dia. perforated GI pipe having 3 mm dia holes 25 mm apart horizontally and vertically, in a staggered manner up to 2.75 M shall be vertically placed in trench. Upper end of the pipe shall be plugged, which shall be visible and 100 mm above GL.

25.4.3. Pipe shall be surrounded with charcoal and lime to a packed thickness of 0.6 M all around the pipe, 0.6 M below and 0.6 M above the bottom end of the pipe. **Resistance of the earth shall not exceed 1 ohm** 0.

25.4.4. Earth conductor from main Earthing point of the HT/LT switch board/transformer to the earth shall be of hard drawn copper conductor 3/0 SWG or copper strip 25 mm x 3 mm which shall be bolted to GI pipe at two places, with brass nuts/bolts 25 mm x 10 mm.

25.4.5. Copper conductor/copper strip shall be buried not less than 75 mm below floor level of the veranda, passage etc, while crossing the same. All necessary channeling shall be made good in all respects with appropriate materials as per original.

25.4.6. Electrode Copper plate, size 300 mm x 300 mm x 5 mm will be provided and fixed to copper strip at the bottom with brass nuts/bolts at-least at three points with the help of additional anchoring pieces.

25.4.6.1. Where the resistance of a single plate is higher than the required value, two or more plates may be used in parallel, and the total resistance is then inversely proportional to the number employed, provided that each plate is installed outside the resistance area of any other (BS 7430).

25.4.7. After back-filling the trenches, surface shall be rammed and brought to level with the ground over which a 75 mm thick, PCC 1:2:4 pit, measuring 300 mm x 300 mm internally, shall be constructed. The walls shall be 150 mm high above the GL. The base of the pit shall be PCC 1:2:4 of 300 mm x 300 mm x 150 mm thick.

25.4.8. The pit shall be covered with a PCC 1:2:4 precast slab 450 mm x 450 mm x 75 mm thick.

25.4.9. Transformer neutral terminal shall be earthed separately and in no case it shall be linked with body earths. Each transformer shall be earthed at two places separately as per specifications.

## 25.5. Aerial Line

25.5.1. **Strength of Conductor.** Strength of line conductors and service line should be in accordance with the latest BS or equivalent PSS.

25.5.2. Max interval between supports for LT and medium pressure lines shall not exceed 55 M.

25.5.3. **Height from GL.** The min computed height from the ground of any line conductors at a temperature of 50°C shall be 6.1 M, the conductor must not be accessible without the aid of ladder or other special appliances.

25.5.4. Height and distance of building or structure where the aerial line is on the building or structure to which persons have access, the min height shall be 4.90 M and in-accessible without the aid of ladder or other special appliances.

25.5.5. **Earthing of Metal Supports.** Stay wires and other metallic accessories.

25.5.6. All metal supports and metals not live, shall be permanently and efficiently earthed. For this purpose, continuous earth wire shall be secured by fastening to each support and connected with earth, the spacing between the points being as nearly equidistant as possible.

25.5.7. Each stay wire shall be similarly earthed unless an insulator has been placed in it, at a height of not less than 3 M from the ground.

25.5.8. **Danger plate** of the following description shall be displayed on HT/ EHT pole. It shall be of sheet iron,·- vitreous enamelled 25cm x 14cm, 16 BG, with red lettering on white background. The lettering shall be in English as well as in Urdu stating "Danger," "Caution" and the pressure.

25.5.9. Phase indication of the following description shall be displayed on each HT/ EHT pole. It shall be of enamelled iron of appropriate colour, 80 mm in dia with 1.75 cm fixing hole.

25.5.10. **Non-Climbable Device** as shown in Figure 25-13 shall be provided on each pole carrying HT / EHT line. It shall be of flat iron clamp with round iron spikes welded to the clamp.

25.5.11. **Factor of Safety**

25.5.11.1. The Factor of Safety shall have following values:-

(1) For Iron or Steel support 4.0

(2) For Wood and Concrete supports. 3.5

(3) For guard wire and Earth wire. 5.0

(4) For Conductors 2.0

25.5.11.2. Calculation of the Factor of Safety:-

(1) The max wind pressure shall be taken 39 Kg/sqm or 80.50 Km/h.

(2) For cylindrical bodies, the effective area shall be taken as *213rd* of the sectional area exposed to wind pressure.

(3) The temperature shall be taken as 0°C or such other temperature as the Engineer-in-Charge specifies.

(4) For Lattice steel or other compounded structure, the wind pressure on the leeside members shall be taken as½ of the wind pressure on the windward side. In localities, where aerial lines are liable to accumulation of ice or snow, it shall be assumed that wires are covered with ice to radial thickness of 6.5 mm.

25.5.12. **Line Crossing or Approaching Each other.** Any telecommunication or other aerial line shall be protected and guarded with approved and efficient means against the possibility of coming into contact with each other.

25.5.13. **Protection from Lightning.** Every aerial line or portion thereof, which is so exposed as to be liable to injury from lightning shall be protected by approved and efficient means.

25.5.14. **Guard Wires.** Safety devices, cradle guards or other approved means shall be provided for rendering a fallen wire dead.

25.5.14.1. Every guard wire shall have an actual breaking load of not less than 682 Kg and shall, if made of iron or steel, be galvanized.

25.5.14.2. Every guard wire or cross connected system of guard wires shall be of sufficient current carrying capacity to ensure the fallen wire rendering dead, without the risk of fusing the guard wire or wires.

25.5.14.3. Every guard wire or system of guard wires and its supports shall be of sufficient strength to carry without breaking, the extra load put of them by the fall of any or all the wires guarded.

25.5.15. **Conductors of Different Pressure on Same Supports**

25.5.15.1. Where conductors forming part of systems at different pressure are erected on the same support, the clearance shall be at least 90 cm between line conductors of different system. Adequate provisions shall be made to guard against the possibility of danger to lineman and lower pressure being charged above its normal working pressure by leakage from or contact with higher pressure systems.

25.5.15.2. The higher pressure system shall always be placed above the lower pressure.

25.5.15.3. Not more than two different pressure systems shall be erected on the same support.

25.5.15.4. Higher pressure more than 11 KV shall not be erected on supports carrying low/medium pressure systems.

25.5.16. **Dip and Stress of wires**

25.5.16.1. The dip or sag shall be based on the assumption that wires are subject to 1/5$^{th}$ of Breaking stress under worst conditions.

25.5.16.2. Sag will be within the limit according to Table 25-1.

**TABLE 25 -1**

HV OVERHEAD LINES

EXTRACT OF MAX SAGS OF HARD DRAWN COPPER LINES COMPLYING WITH THE ELECTRICITY COMMISSIONER'S REGULATIONS E1 C-53

(97 CM RADIAL ICE, 58 KG/SQM, WIND SAFETY FACTOR 2).

SAGS AT 50°C IN STILL AIR

| Area $mm^2$ | Strand | Max Working Tension Kg | Sag in meters at 50°C for spans of | | | |
|---|---|---|---|---|---|---|
| | | | 50m | 60m | 70m | B0 m |
| 16.44 | 3/0.104 | 0.35 | 0.60 | 0.98 | 1.42 | 1.92 |
| 25.55 | 7/0.086 | 0.56 | 0.37 | 0.59 | 0.86 | 1.19 |
| 32.85 | 3/0.147 | 0.66 | 0.37 | 0.57 | 0.82 | 1.12 |
| 38.70 | 3/0.161 | 0.79 | 0.34 | 0.52 | 0.74 | 1.01 |
| 47.43 | 3/0.180 | 0.97 | 0.32 | 0.49 | 0.68 | 1.21 |
| 65.60 | 7/0.136 | 1.33 | 0.28 | 0.41 | 0.56 | 0.74 |
| 75.33 | 7/0.152 | 1.64 | 0.28 | 0.40 | 0.55 | 0.72 |
| 97.74 | 7/0.166 | 1.94 | 0.28 | 0.40 | 0.54 | 0.70 |
| 132.10 | 7/0.193 | 2.56 | 0.29 | 0.41 | 0.54 | 0.70 |
| 163.90 | 7/0.215 | 3.14 | 0.29 | 0.41 | 0.54 | 0.70 |

25.5.17. **Spacing of Conductor.** This shall be regulated by two factors i.e. pressure and sag. It shall not be less than 30cm in case of Low/ Medium pressure and 90cm in case of High pressure upto 11 KV.

25.5.18. **Steel Tubular Poles**

25.5.18.1. **Material.** The poles shall be fabricated from steel structural tubes complying with BS-1387. Steel used for tubes should meet the following requirements:-

(1) Tensile strength - Min 34.72 Kg/ $mm^2$
- Max 47.35 Kg/ $mm^2$

(2) Yield point - Min 24.70 Kg / $mm^2$

(3) Elongation in 200 mm sample - Min 20%

25.5.18.2. **Construction**

(1) **Base plate.** Specification of base plate shall be as per Table 25-2:-

**TABLE 25 -2**

**Specifications - Base Plate**

| Length & Width "a" ( mm) | Thickness "t" ( mm) | Weight ( Kg) |
|---|---|---|
| 300 | 15 | 11 |

(2) The poles shall be constructed according to the details as indicated on the drawings and shall conform to the dimensions depicted in Table 25-3 & 25-4.

(3) Each section of the steel tube as cut to the specified length shall be tapered at one end in pneumatic press, after the ends are made red hot in a furnace.

(4). The joint shall be single V-Groove joint, welded with complete penetration and backing. The welds shall be grinded off to give smooth finish to the pole.

(5) For giving additional weld strength, a sleeve will be provided at each joint, as indicated in the drawings.

25.5.18.3 **Galvanizing.** Galvanized poles shall be fabricated from galvanized steel pipe sections. For galvanizing, MS pipes shall be pickled in acid solution and to pass through the heating chamber after fluxing. The pipes shall then be dipped in molten zinc kettle. The excess zinc adhering on the external and internal surface of the pipe shall be wiped off by passing the hot zinc coated pipe through a system of compressed air ring and an internal steam shooting device. The galvanizing shall be free from lumps blisters uncoated or porous spots black spots, flux or any other imperfection. The joints of such poles shall then be painted with two coats of zinc-enriched paint.

25.5.18.4. **Painting.** Pole fabricated from un galvanized steel pipe sections shall be painted with two coats of red Lead primer from top to ground line after exterior surface is thoroughly cleaned, the remaining exterior surface i.e. below ground line and interior surface throughout be painted with two coats of bituminous paint.

**TABLE 25-3**

(1) **Transmission Poles**

| Overall Length | Height above Ground | Buried Length | Point of load application | Outside dia of sections | | | Thickness of section | | | Length of sections | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | B | A | C | D1 | D2 | D3 | T1 | T2 | T3 | L1 | L2 | L3 |
| 9000 | 7475 | 1525 | 300 | 165 | 140 | 114 | 4.85 | 4.85 | 3.65 | 3000 | 3000 | 3000 |
| 12000 | 10170 | 1830 | 450 | 168 | 140 | 114 | 4.78 | 4.85 | 3.65 | 6000 | 3000 | 3000 |

Note: All dimensions are in mm

**TABLE 25-4**

(2) **Street Light poles: - Single Arm & Double Arm**

| Overall Length | Height above Ground | Buried Length | Point of load application | Am, dimension | | Outside dia ofsection | | | | Thickness | | | | Length ofsections | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | B | A | C | A | B | D1 | 02 | D3 | D4 | T1 | T2 | T2 | T4 | L1 | L2 | L3 | L4 |
| 10792 | 9130 | 1662 | 300 | 1500 | 140 | 114 | 88 | 48 | 48 | 4.85 | 3.65 | 3.25 | 2.90 | 3292 | 3000 | 3000 | 2540 |

Note: All dimensions are in mm

25.5.18.5. **Tests**

25.5.18.5.1. Steel tubular poles shall be subjected to the following tests:-

(1) Visual inspection for freedom from finishes defects.

(2) Verification of dimensions for length, outer dia. and thickness etc.

(3) **Transverse Load Test.** Three poles selected at random from a lot shall be tested to failure and to a load equal to twice the full test load (the safe working load). For poles tested to failure, the value of the failure load, in no case shall be less than 2.5 times the full test load (safe working load).

25.5.18.5.2. Details of different test loads are given in Table 25-5 & 25-6:-

**TABLE 25 • 5**
**Transmission Poles**

| Overall length (mm) | Safe working Load (Kg) | Load for temporary deflection of 150 mm (Kg) | Load for permanent set of 15 mm (Kg) |
|---|---|---|---|
| 9000 | 166 | 125 | 199 |
| 12000 | 168 | 65 | 202 |

**TABLE 25 -6**
**Street light poles: Single Arm & double Arm**

| Overall length (mm) | Safe working Load (Kg) | Load for temporary deflection of 150 mm (Kg) | Load for permanent set of 15 mm (Kg) |
|---|---|---|---|
| 10792 | 80 | 55 | 95 |

25.5.18.5.3. **Tolerances.** Following tolerances shall apply to all steel tubular poles:-

(1) Length of each section ± 25 mm

(2) Outside dia ±10%

(3) Thickness ± 10% - 8%

(4) Temporary deflection 5% over

25.5.18.5.4. **Method of Testing**

(1) The pole shall be erected in true vertical position, in such a manner that it is held rigidly and that there is absolutely no possibility of any movement at the base or at the ground line. The free height of the pole above ground shall be the same as indicated in Tables 25-3 & 25-4.

(2) Test loads shall be applied to the structure at 300 or 450 mm (as read) from top in a horizontal direction with the help of steel wire rope (SWR) attached to the pole, in such a manner that the pole is stressed in same way as in actual working conditions. The loading rope shall have in it a spring balance or any other loading arrangement of suitable capacity and accuracy. The loading rope shall pass over a pulley and shall on the other end be loaded with weights.

(3) The load shall be increased gradually in increments of 25 Kg until the specified test load is reached. The test load shall be held for 5min and gradually removed. During the application of load, deflection shall be recorded at each increment of load. After the removal of load the permanent deflection shall be recorded after a test period of 5 min. The load shall then be re-applied in the manner stated above until the applied load equals 1.5 times the test load. Measurements of temporary and permanent deflections and corresponding loads as indicated above shall be recorded during all the tests. After the test at 2.5 times the test load, the load shall again be applied and gradually increased until failure occurs.

(4) All test equipment including rig fixture arrangement for pole erection, loading aids, deflection-recording instrument, steel rope, clamps etc as approved by the Engineer-in-Charge shall be arranged by the contractor free of cost.

(5) If the contractor fails to arrange the test equipment, the tests shall be carried out at a suitable test bench, at risk and cost of contractor as directed by the Controlling Officer.

25.5.18.6. **Erection of Poles**

(1) Digging holes and concrete beds for steel tubular poles, R.C.C and pre stressed concrete poles.

(2) The excavation for poles shall be according to the buried lengths given in the dimension tables for transmission and street light poles. The holes shall be diagonal of base plate 100 mm wide or other dimension as specified in drawing. PCC 1:4:8150 mm, shall be laid in bed.

(3) Pole shall be erected straight in the hole and 80 mm PCC 1:4:8 muffler shall be provided all around the pole to the entire depth up to 150 mm above GL. After setting of muffler, the remaining portion of the hole shall be filled with pebbles or brick bats (over or properly burnt) up to 900 mm. The remaining portion shall be filled with earth, well-watered, rammed in layers not exceed 150 mm. All surplus spoil shall be removed and the site shall be made good.

25. 5.18.7. **Lattice Steel Poles**

25. 5.18.7.1. **Materials**

25.5.18.7.1.1 The poles shall be fabricated from structural steel complying with ASTM A-36, It shall meet the following requirements:-

(1) Min tensile strength - 40.0 Kg/mm$^2$

(2) Max Tensile strength - 56.0 Kg/mm$^2$

(3) Min yield point 25.0 Kg/mm$^2$

(4) Elongation in 200 mm gauge length for angle Iron of 5 mm (3/16") thickness, min 15%.

(5) Elongations in 200 mm gauge length for angle Iron of 3 mm (1/8) thickness, min 12.5%.

25.5.18.7.1.2. The zinc used for galvanizing shall comply with BS 3436 and shall be of 99.5 % purity.

25.5.18.7.1.3. Bolts and nuts shall be made of Mild Steel and comply with ASTM A-394.

25.5.18.7.2. **Construction**

(1) The welded lattice steel poles shall be made from rolled shapes generally in accordance with WAPDA Drawing No PDW/DF-10 and PDW/DF-11. These shall be hot dip galvanized.

(2) The poles shall be entirely welded. There shall be no joints in the main legs upto a height of 3 M from the GL point.

(3) The poles shall be similar on all four faces. The holes shown on the drawings shall be provided on all four faces.

25.5.18.7.3. **Tolerance**

(1) The dimensions shall be in accordance with and within the tolerances stated on drawings. Where no tolerance is stated, it shall be.! 5 % subject to a min of 3 mm.

(2) The structures shall be straight within 1/300 of their length. This applies to two-piece structures when assembled.

(3). The weight of any structure shall not deviate from the calculated weight of structures or approval, which shall include the nominal weight of steel including weld metal, the weight of the zinc galvanizing and the nuts and bolts.

25.5.18.7.4. **Galvanizing**

(1) Shall be hot dip galvanized to conform to ASTM A-123. Prior to galvanizing the poles shall be fabricated and welded as required, free from burrs, cleaned and thoroughly prepared, so that the zinc coating shall be adherent, dense, smooth, continuous and uniform. Care shall be taken to completely remove all welding scale. The galvanizing shall be completely free from lumps, blisters, uncoated or porous spots, black spots, dross, flux or any other imperfections. All structural steel wrapped by the galvanizing process shall be straightened by re-rolling or pressing. The material shall not be hammered or otherwise straightened in a manner, which may injure the galvanized coating.

(2). All bolts and nuts shall be hot dip galvanized, including threaded portions in accordance with ASTM A-153, nuts shall have a finger tight fit on the bolts and develop the full strength of the bolts.

25.5.18.7.5. **Testing**

25.5.18.7.5.1. The loads for transverse loading tests shall be as follows:-

(1) Type 'L' Pole - 163 Kg

(2) Type 'H' Pole - 313 Kg

25.5.18.7.5.2. Any permanent deflection after the application and removal of the full test load shall mean non-compliance with this specification. Failure at or before 2.5 times the test load shall also mean non-compliance with this specification. All poles tested shall comply with these requirements.

25.5.18.7.6. **Sample Tests.** Following sample tests shall be carried out on the lots offered for acceptance: -

25.5.18.7.6.1. **On Complete Poles**

(1) Visual inspection.

(2) Verification of dimensions and weights.

(3) Transverse load test.

25.5.18.7.6.2. **On Members**

(1) Tensile strength and elongation test, in accordance with ASTM E 3-61.

(2) Embitterment test, in accordance with ASTM A-143.

(3) Galvanizing test, in accordance with ASTM A-123.

25.5.18.7.7. **Method of Testing**

(1) The contractor shall provide a rig or fixture duly approved by Engineer-in Charge for erecting the pole in true vertical position, in such a manner that it is held rigidly and that there is absolutely no possibility of any movement at the base or at the ground line. The height of pole above ground line shall be the same as in actual working conditions, which normally are: -

(a) 7772 mm for **'L' Type** pole.

(b) 8640 mm for **'H' Type** pole.

(2) Before erecting the pole in the manner described above the jointing bolts, if any, shall be fully tightened.

(3) The test load shall be applied to the structure at one foot below the top on a horizontal direction with the help of a SWR attached to the pole, in such a manner that the pole is stressed in the same way as in actual working conditions. This may be achieved by attaching two strips of steel on opposite faces and tightening them in position, with the help of a double arming bolt, to which the rope is attached. The loading rope shall have incorporated in it a spring balance or any other loading attachment of suitable capacity and accuracy. The loading rope shall pass over pulley and shall on the other end be loaded with weights.

(4) The load shall be increased gradually in increments of about 23 Kg until the specified test load is reached. The test load shall be held for 5 min and gradually removed. During the application of load the deflection shall be recorded at each increment of load. After the removal of load the permanent deflection shall be recorded, after a test period of 5 min. The load shall then be re-applied in the manner stated above until the applied load equals 1.5 times the test load. The pole shall be unloaded and this procedure shall be repeated for loads equal to 2.0 and 2.5 times the test load. Measurements of temporary and permanent deflections and load as indicated above shall be recorded during all these tests. After the test at 2.5 times the test load, the load shall again be applied and gradually increased until failure occurs. The failure load shall be recorded. Failure will reach when the pole will not support any further load or a sudden buckling of some member occurs.

(5) The measurement of deflection at the top shall be made with the help of a level or theodolite. This shall be achieved by fixing instrument at a certain distance from the testing position and sighting pre marked point on top of the structure. The precision of measurement shall be ± 1 mm for deflection and± 9 Kg load.

25.5.18.7.8. **Erection.** This type of pole shall be erected as indicated in the drawings (Figure 25-11 and 25-12).

25.5.18.7.9. **Stringing of Conductors**

(1) All conductors shall be placed on the groove of the pin type insulators in straight length, except in small curves or bends, where these shall be placed on side grooves with the prior approval of the Engineer-in-Charge. The conductors shall be fixed to the shackle/ strain insulators at the terminal or intermediate pole, the max length between intermediate or terminal poles shall not exceed 365 M or 8 spans whichever is less, on straight runs and at bends. At points of terminations the conductors shall be fixed to the shackle/strain insulators.

(2) All conductors shall be secured efficiently in approved manner to insulators with soft tinned copper binding wire of approved size.

(3) Particular attention shall be paid to see dip or sag, so that all conductors on the same cross arms shall be of equal height from ground throughout the span. Attention shall also be paid to avoid kinks, sharp bends or any other injuries to the conductors during straining.

25.5.18.7.10. **Jointing and Binding.** Britannia or any other suitable method shall be employed in jointing solid conductors. Twisting of solid conductor is not allowed. Any suitable method shall be employed for jointing stranded conductors. The method shall be approved by the Engineer-in-Charge before jointing of stranded conductors commences.

25.5.18.7.11. **Stay and Stay Wire.** Stay assemblies and stay wire shall be of sufficient strength to withstand the load on them. These shall be provided either to straight the line at terminal poles or to bring up construction on the straight length to the required straight. They shall be fixed to post, if possible

above the line wires or at the resultant point between them, not below. They shall be fixed at an angle in each alignment rather than in the resultant direction, if sufficient space is available. Stay wire shall not be directly fixed on poles by twisting them round the pole, but shall be fixed through suitable clamps of sufficient strength. An insulator shall be fixed to stay wire not less than 3 M from ground. If no insulator is provided, then the stay wire shall be properly and efficiently earthed. However, this does not apply to High-pressure system.

25.5.18.7.12. **Setting of Stay Rod.** Sufficient excavation of earth be carried out to a depth of 1.37 M, so as to give correct angle to the stay wire. Stay rod and plate be erected in proper position and embedded in PCC 1:3:6 upto 0.5 M from the bed level and the rest of the pit be properly refilled and rammed after the initial setting of concrete. Fixing of stay be completed one week thereafter. Stay of service bracket shall be 3/10 or 7/16 SWG-GI and shall be fixed on one side with a proper hook of MS bar or flat suitably anchored in wall and with a suitable clamp on service bracket on the other side.

## 25.6. Under Ground System

25.6.1. **Excavation for Trenches.**

25.6.1.1. The excavation shall be deep in accordance with Table 25-7 & 25-8. The width of the trench shall have max outer dia of cable +23 cm. The surface of the bed shall be levelled and made free of any pointed and sharp edged material.

25.6.1.2. All places where cables are to be jointed, the depth shall be increased by 46 cm, the width and breadth shall also be increased by 30 cm and 90 cm respectively on both sides of the trench, to provide space for workmen for jointing.

25.6.2. **Laying of cables.** Burnt bricks shall be laid dry flat to obtain width equivalent of length of brick on bed of the trench, over which a 7.5cm layer of sand free from any edged material, (pebbles, stones or other inorganic materials), shall be spread and then cable is laid. Another 7.5cm similar layer of sand shall be spread on top of the cable and then covered with bricks. The bricks will be laid flat as before. The remaining portion of the trench will then be filled in, with earth and well rammed.

25.6.3. **Crossing Roads, Streets and Pavements, etc.** The trenches shall be covered with pre-cast slabs of sufficient strength to withstand the load over them and prevent injury to cable.

25.6.4. **Crossing Culverts and Bridges.** The cables shall be drawn in suitable size of steel, GI or CI tubing which shall be properly secured by suitable hooks or clamps etc, to the culverts and bridges.

25.6.5. **Jointing of Cables**

25.6.5.1. While laying the cables, it shall be so arranged that cables to be jointed have an overlap of about 31cm to provide ample length for jointing. The serving and armouring shall be removed from both cables to conform to the dimensions of the box. The lead sheath is then to be cut off from both cables, to box dimensions. The belt paper shall be removed to within 25 mm of the lead sheathing at each end exposing the insulated core. The insulation shall be removed the required length. All joints shall be sweated, wiped clean and properly insulated as per latest BSS or equivalent PSS.

25.6.5.2. At least 25 mm clearance shall be allowed between the centres of each pair of joints. The armouring shall be properly bound and the box shall be replaced in the filling holes. Necessary tapping shall be carried out after the compound has cooled.

25.6.6. **Jointing and Termination of XLPE/ PVC Cables.**

25.6.6.1. Hot poured compound has an adverse effect on the insulation of XLPE/ PVC cables. As this type of compound causes swelling thus creating a weak point in the joint and also because of chemical reaction, semi-conducting tape is punctured after some time. This results in earth fault. As such, hot poured jointing compound shall not be used in the jointing of XLPE/ PVC.

25.6.6.2. The jointing of XLPE/PVC Cables only PVC pre-moulded cable joints/terminations both outdoor and indoor, with cold filled material called 'Resin' shall be used. The selected resin shall be of low viscosity, flame retardant and have good track resistance, together with resistance against chemical and climatic influences. After the resin has been cured, it must conform to min levels laid down in "Properties of cured Resin Type G", according to **DIN** 57291, Part II.

25.6.7. **Straight Joint-11 KV**

25.6.7.1. Straight joint kit should consist of:-

(1) Moulds of high mechanical strength PVC instead of CI boxes.
(2) Required amount of resin and padding tapes.
(3) Semi conducting tapes.
(4) HV/ self amal amating tape.
(5) Connectors of sizes
(6) Jubilee clips
(7) Earth wire.

**TABLE 25-7**
**Minimum Cover Requirements, 0 to 1000 volts,**
**Nominal Burial** in **Millimetres/Inches (NEC 2017 Table 300.5)**

| Type of Wiring Method or Circuit | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location of Wiring Method or Circuit | Column 1 Direct Burial Cables or Conductors | | Column 2 Rigid Metal Conduit or Intermediate Metal Conduit | | Column 3 Non-metallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceway | | Column 4 Residential Branch Circuits Rated 220 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes | | Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or In Other Identified Cable or Raceway | |
| | mm | In. | mm | In. | mm | In. | mm | In. | mm | In. |
| All locations not specified below | 600 | **24** | 150 | 6 | 450 | 18 | 300 | 12 | 150a,b | 6a,b |
| In trench below 50 mm (2 in.}thick concrete or equivalent450 | 450 | 18 | 150 | 6 | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building | 0 (in raceway or Type MC or Type MI cable identified for direct burial• | 0 | 0 | 0 | 0 | 0 | 0 (in raceway or Type MC or Type MI cable identified for direct burial} | 0 | 0 (in raceway or Type MC or Type MI cable identified for direct burial} | 0 |
| Under minimum of 102 mm (4 in.} thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.} beyond the underground installation | 450 | 18 | 100 | 4 | 100 | 4 | 150 (direct burial) 100 (in raceway} | 6 4 | 150 (direct burial) 100 (in raceway} | 6 4 |
| Under streets, highways, roads, alleys, driveways, and parking lots | 600 | **24** | 600 | **24** | 600 | **24** | 600 | **24** | 600 | **24** |
| One-and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes | 450 | 18 | 450 | 18 | 450 | 18 | 300 | **12** | 450 | 18 |

**TABLE 25-8**
**Minimum Requirements over 1 KV to 22 KV,**
**Nominal Burial in Millim&tres /Inches ( NEC 2017 Table 300.5)**

| Circuit Voltage | General Conditions (not otherwise specified) | | | | | | Special Conditions (use if applicable) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Column 1 | | Column 2 | | Column 3 | | Column 4 | | Column 5 | | Column 6 | |
| | Direct-Buried Cables | | RTRC PVC, and HOPE Conduit | | Rigid Metal Conduit and Intermediate Metal Conduit | | Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness | | Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited | | Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas | |
| | mm | In | mm | In. | mm | In. | mm | In. | mm | In. | mm | In. |
| Over 1000 V through 22 kV | 750 | 30 | 450 | 18 | 150 | 6 | 100 | 4 | 450 | 18 | 600 | 24 |

25.6.7.2. **Method of making XLPE/PVC Cable Joint**

(1) Remove outer PVC of the cable and expose armour.

(2) Bind armour on both ends by means of jubilee clips.

(3) Remove filter and expose PVC sheath, remove PVC sheath and expose cores.

(4) Remove copper screen and level about 50 mm at ends.

(5) Remove semi conducting tape.

(6) Clean very carefully the cor s. Cleaning must not be done with kerosene oil but with *BENZIN* or *TRI-CHLORETHANE.* Cleaning cores is very important process and there must not be any trace of semi-conducting particles on the core.

(7) Punch connectors of sizes either copper or aluminium.

(8) Apply two layers of semi-conducting tape on the core leaving exposed copper screen.

(9) Provide two layers of HV self amalgamating tape from one end to other covering earth wire binding on all the three cores.

(10) Build earth wire continuity with copper braid by jointing the exposed screen.

(11) Build main cable earth by providing earth strip or insulated wire through jubilee clips (two).

(12) Place mould, when it is fixed, then apply padding on both the ends. Fix the funnels, and pour the resin.

25.6.7.3. **Method for making LT Straight Joint (Resin filled)**

(1) The cable length reaching the mould should be double the dia of cable used, with cables over 25 mm dia., 50 mm should be taken in the mould.

(2) Cut the steps with saw. The opening should be slightly larger than the cable dia.

(3) Distance between connectors should be min 5 mm for voltage upto 1 KV, increase the same by 1 mm per KV voltage upto 11 KV.

(4) Cable overall sheath or metal jacket, especially lead, sheath, should be thoroughly cleaned.

(5) Plastic cable sheath inside the mould should be wrapped with the tape included in the kit. The tape should be stretched and overlapped approximately 50% and applied in two layers.

(6) Halves of the mould should be fitted round the splice and snapped together.

(7) The mould ends with tape and fit the stopper.

(8) The resin in the bag, according to printed instructions.

(9) Put resin into the funnel, until it is completely filled.

(10) Upto 1 KV, as soon as the mould is completely filled, the cable can be put under voltage. For over 1 KV, wait until the resin has cured. After curing, cut off the funnels.

25.6.7.4. **Method of Making LT Straight Joint (Heat Shrink)**

(1) Clean both ends of cable and slide external HS tube one end.

(2) Remove the cable sheath and expose the cores.

(3) Keep the cores of one end little longer than the inner sleeves, so that crimping of connectors is done without obstruction. Remove insulation from the conductor according to size of the connector and crimp

(4) Slide the inner HS tubes over the connectors and shrink them, starting from centre with soft flame until the adhesive protrudes gently at the end.

(5) Slide external HS tube over the cable ends and shrink starting at the centre, then right or to left with soft flame.

(6) For armoured cable, armour can be connected by means of PVC insulated cables and jubilee clips at both ends.

(7) Study working instructions for measurement of cable core.

25.6.7.5. **Terminations.** Termination kit should be pre-moulded dry type for indoor and outdoor use suitable for rapid installation and disconnection. It should be suitable for 11 KV distribution system with a min short circuit rating of 25 KV and for use in adverse climatic conditions and ambient temperatures. Relative humidity may range to 100%.

25.6.7.6. **Components. Dry type Pre-moulded Termination**

**25.6.7.6.1.0utdoor Terminations:-**

(1) Cable lugs, (Copper, Aluminium or Bi-metal).
(2) Sealing End caps, EPDM Semi Conductor.
(3) Skirts EPDM Grey (Insulator).
(4) Stress Release cone EPDM.
(5) Earthing devices.
(6) Jubilee clips and main earth wire.
(7) Three core HS boot.
(8) Semi conducting tape.
(9) PVC Tape.
(10) Silicone Grease.
(11) Self Amalgamating tape or HS tube of black colour to protect cable core against ultra violet sun rays.

25.6.7.6.2. **Indoor Terminations:-**

(1) Lugs (copper, Aluminiu or Bi-metal).
(2) Introducing cap.
(3) Stress relief cone made from semi conducting EPDM rubber.
(4) Semi Conducting tape.
(5) Self Amalgamating tape.
(6) Silicone Grease.
(7) Earthing device.
(8) PVC Tape.
(9) Jubilee clip and main Earth wire.

25.6.7.7. **Terminations - LT (Resin Filled):-**

(1) Keep the cable in position, and measure to length required for termination.
(2) Remove cable sheath and expose cable cores.
(3) Clean the cable sheath and metal jackets with wire brush.
(4) Remove PVC insulation over the conductors from the cores that remain in the box.
(5) Cut the steps of the moulds, the opening should be slightly larger than the cable dia.
(6) Both halves of the mould be filled and snapped together over the splice. Fit the lid and check the centering of cores.
(7) Seal the mould end with tape and fit the funnels.
(8) Mix the resin according to printed instructions, and pour the resin until the resin rises in both the funnels.
(9) After the resin is cured, cut off the funnels.

25.6.7.8. **Method of Making LT Termination (HS):-**

(1) Remove cable sheath to the length required.
(2) Secure armour by means of jubilee clips before cutting.
(3) Connect main earth to armour.
(4) Clean cable sheath and armour with wire brush.
(5) Spread cores and H.S boot over the cores and shrink.
(6) Remove insulation of core according to the size of lug and crimp the lug.

25.6.7.9. **Route and Joint Signs:-**

(1) Casted embossed signs stating pressure and owner's name shall be provided at every 91 M along the route.
(2) At the joints a similar sign stating the above particulars and the word "JOINT" shall be provided.
(3) All signs will be approved by the Engineer-in-Charge.

**25.7. Siting of External Service to Important Buildings**

25.7.1. Electric service connection to officer's bungalows and buildings, where appearance is important, shall be brought to the rear of the building or failing that on the side.

25.7.2. In case of buildings which are especially important, the service shall be brought in, by underground cable.

**25.8.** No work will be entrusted to a contractor who has not employed a licensed supervisor as required under the Electricity Regulations, Govt. of Pakistan.

**25.9. Tests**

25.9.1. The completed lines shall comply with following tests:-

(1) Earth continuity resistance test.
(2) Cables insulation and continuity test.
(3) Overhead conductor's continuity test.

25.9.2. The time at which these tests are carried out shall be arranged between the Contractor and the Engineer-in-Charge. The contractor shall supply the necessary apparatus, labour and instruments but the Engineer-in-Charge is at liberty, to use for this purpose any instruments he may wish to employ, the results of the tests shall be recorded in triplicate by the contractor and signed both by the contractor and the Engineer-in-Charge.

**25.10. The Complete System** shall be put in commission by the contractor. The completion drawings with tests results prepared by a licensed supervisor employed by the contractor shall be handed over to the Engineer-in-Charge, before final payment.

## METHOD OF MEASUREMENTS

**25.11.** All overhead conductors and cable of different sizes shall be measured per linear dimension nearest to cm. The sag shall be added in accordance with manufacturer's manual.

## CLARIFICATION OF RATES

**25.12.** Payment for steel/ PCC platform for transformers to be made separately under appropriate schedule items. Pad mounted transformer consist:-

(1) HT compart includes HT linking arrangement, barrel fuses alongwith 6 spares and suitable HT operating rod.
(2) LT compart includes one main, four sub mains control breaker, insulated bus bars of suitable current carrying capacity and thimbles all as per manufacturers specifications.

**25.13.** Mounting and dismounting of Pole mounted transformers to be paid separately.

**25.14.** The rates include pole caps for transmission steel tubular poles and opening and locking system for street light tubular poles.

**25.15.** The rates include the cost of binding wire for binding, jointing, tee off etc, of conductors and cables.

**25.16.** The rates include the cost of compound, insulation tapes, soldering, preparation of extension leads and fixing at required place with all clamps, nuts and bolts etc for cable boxes.

**25.17.** The turned end of different sizes of conductors/ cables for binding at ends overlap, looping & tee off etc shall be measured per linear dimension nearest to cm.

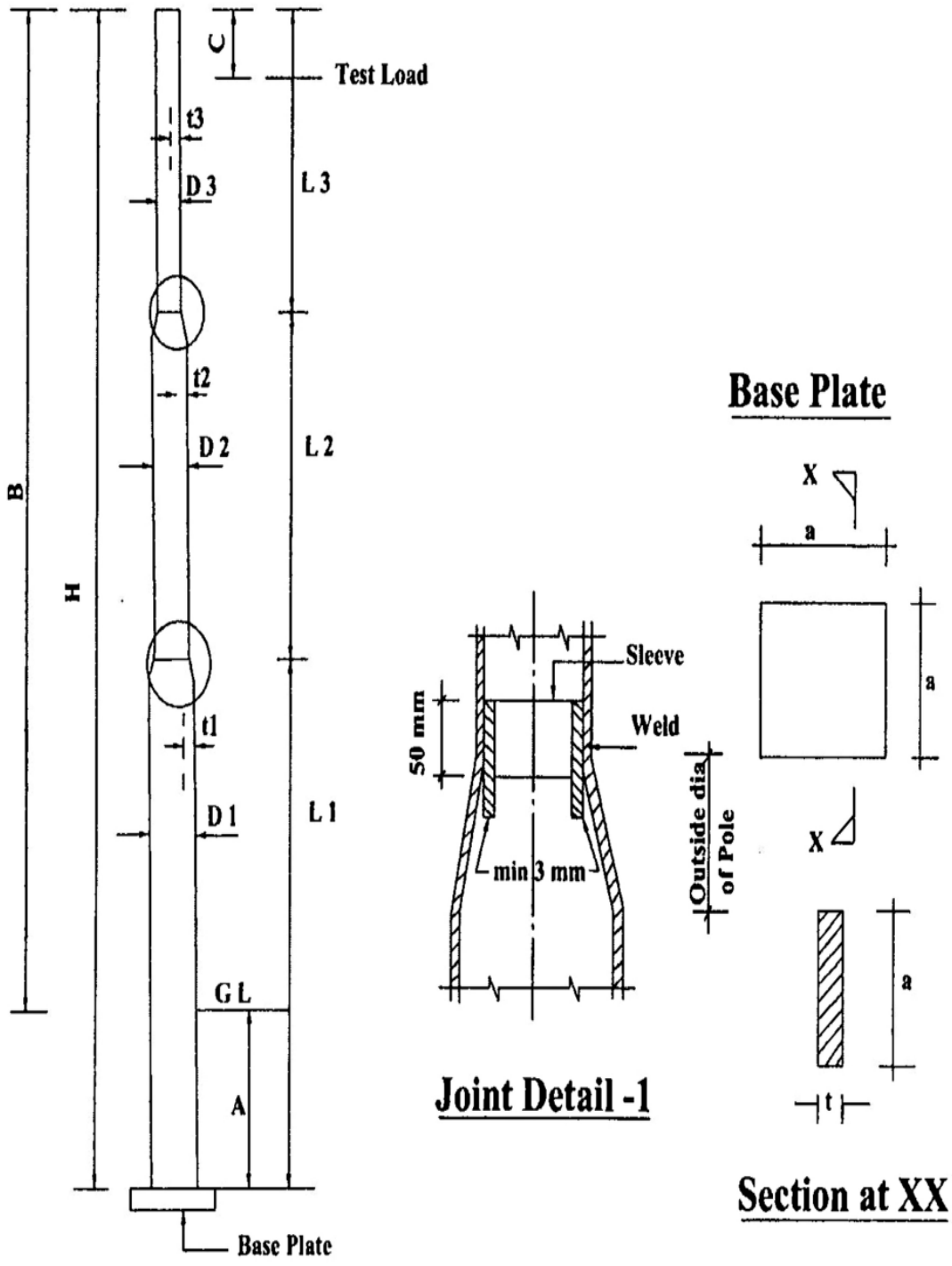
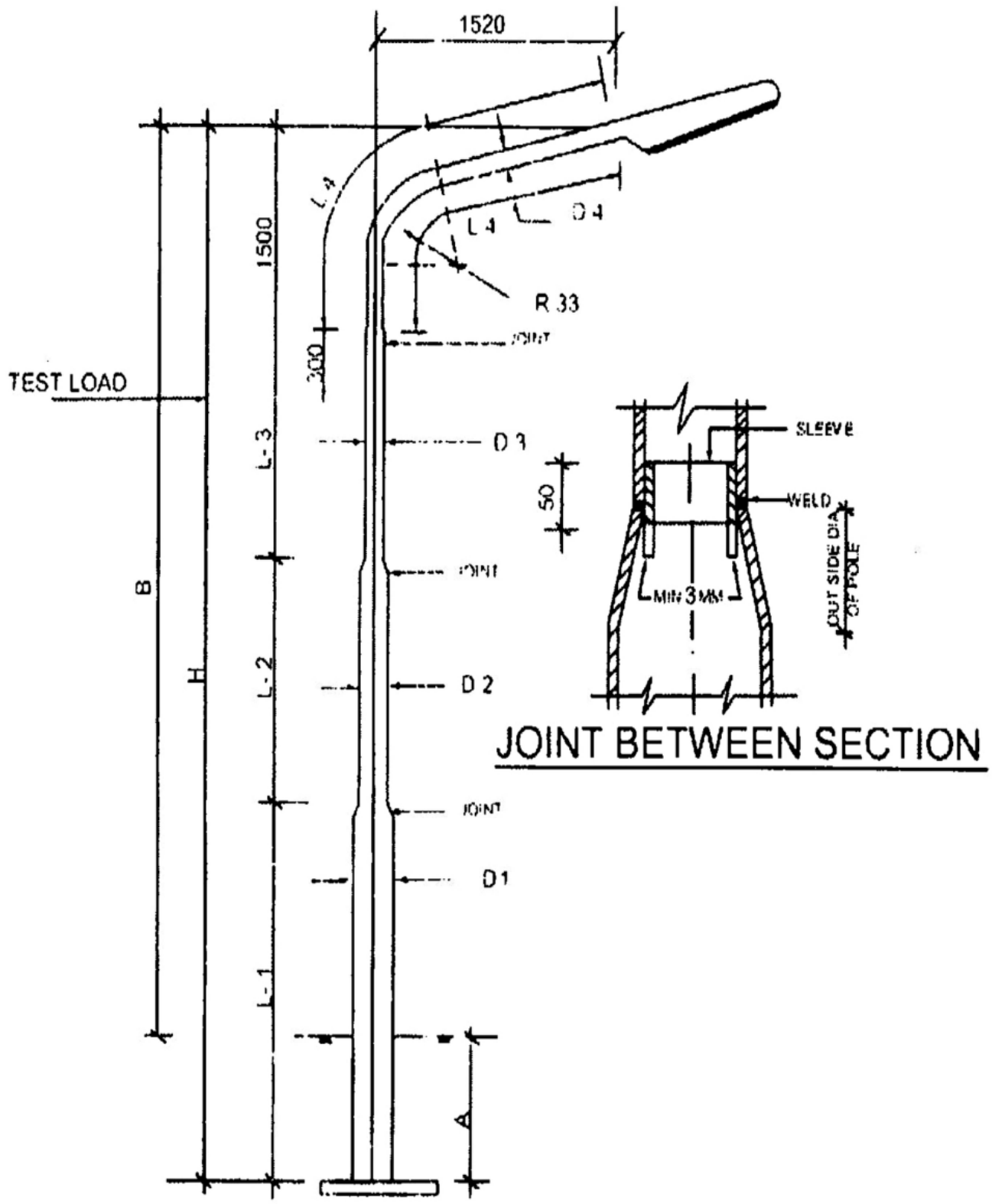



FIGURE : 25-1

STEEL TUBLAR POLE - 9 M and 12 M LENGTH

(TRANSMISSION)



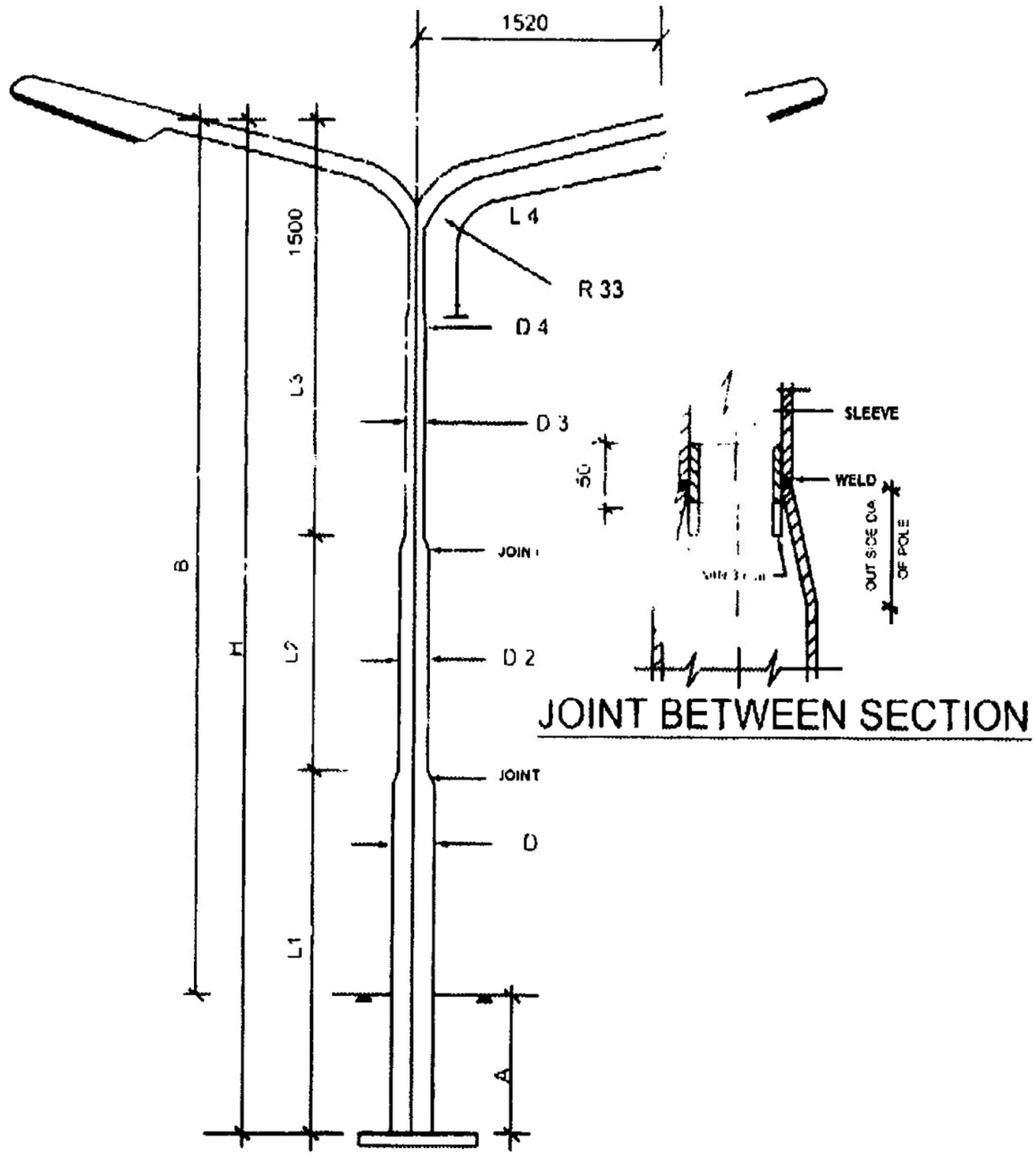

## JOINT BETWEEN SECTION

| OVERALL LENGTH | OUTSIDE DIA & THICKNESS OF SEC | | | | | LENGTH OF SEC | | | |
|---|---|---|---|---|---|---|---|---|---|
| H | | D1 | D2 | D3 | D4 | L1 | L2 | L3 | L4 |
| 10792 | OD mm | 140 | 114 | 88 | 48 | 3292 | 3000 | 3000 | 2540 |
| | Wall Thickness | 4.85 | 3.65 | 3.25 | 2.90 | - | - | - | - |

**FIGURE : 25-2**

**STEEL TUBLAR POLE SINGLE ARM**

(STREET LIGHTING)




| OVERALL LENGTH | OUTSIDE DIA & THICKNESS OF SEC | | | | | LENGTH OF SEC | | | |
|---|---|---|---|---|---|---|---|---|---|
| H | Sec | D1 | D2 | D3 | D4 | L1 | L2 | L3 | L4 |
| 10792 | OD mm | 140 | 114 | 88 | 48 | 3292 | 3000 | 3000 | 2540 |
| | Wall Thickness | 4.85 | 3.65 | 3.25 | 2.90 | - | - | - | Both Arms |

**FIGURE : 25-3**

**STEEL TUBLAR POLE DOUBLE ARM**

(STREET LIGHTING)

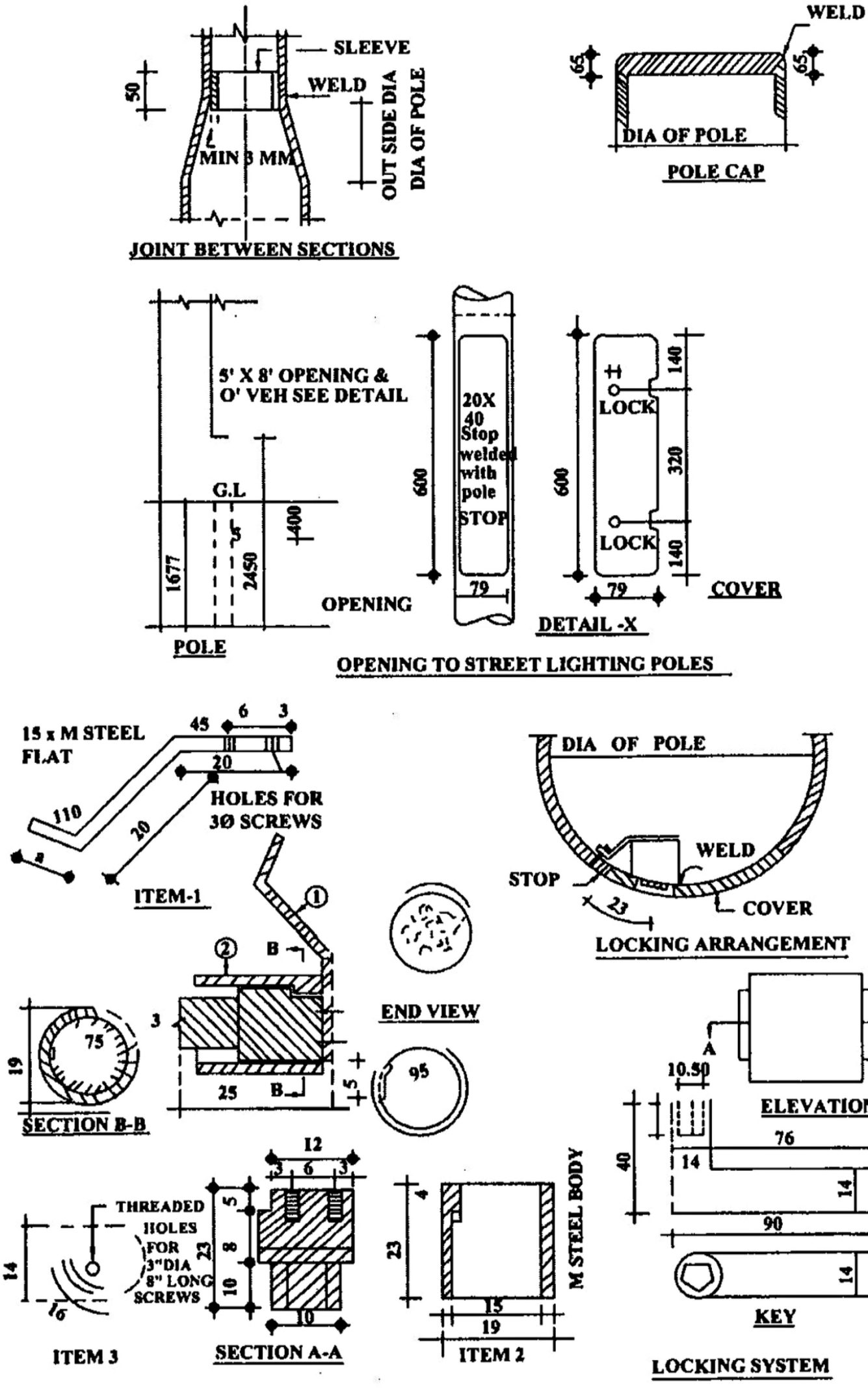



**FIGURE 25-4 : SECTION DETAILS**

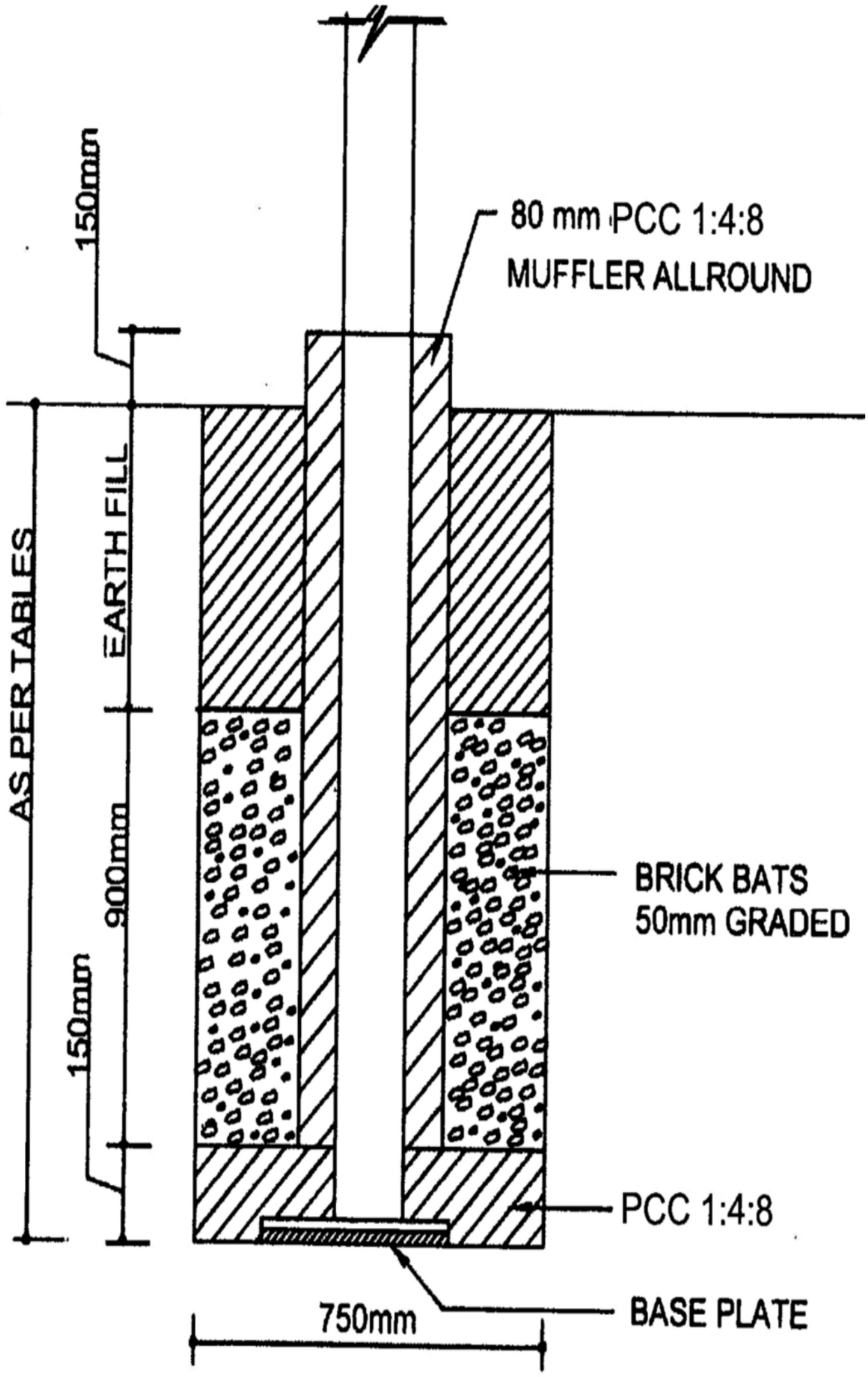
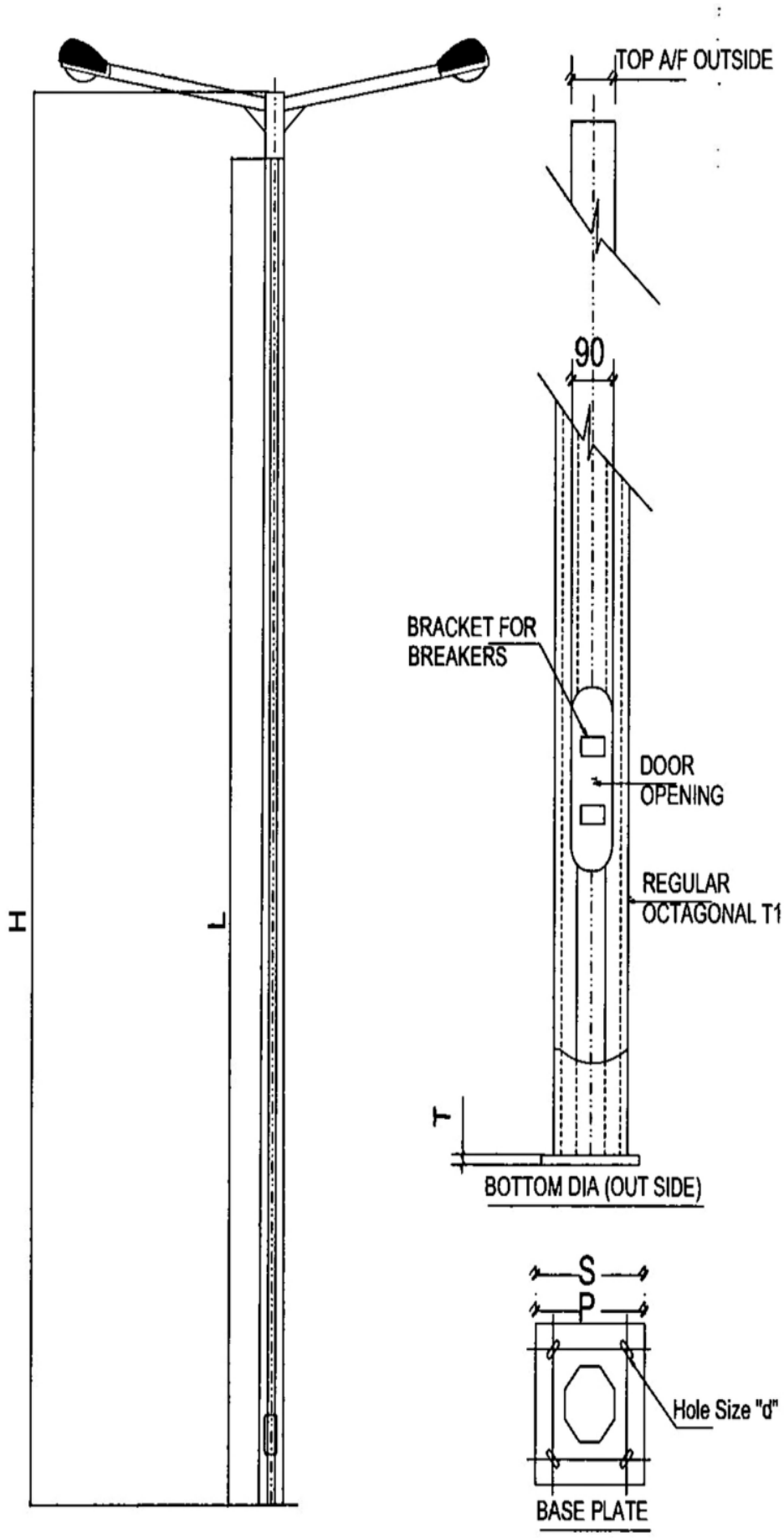



FIGURE : **25-5**

**FIXING** OF STEEL **TUBLAR** POLE

**9 Mand 12 M** LENGTH




OCTAGONAL POLES

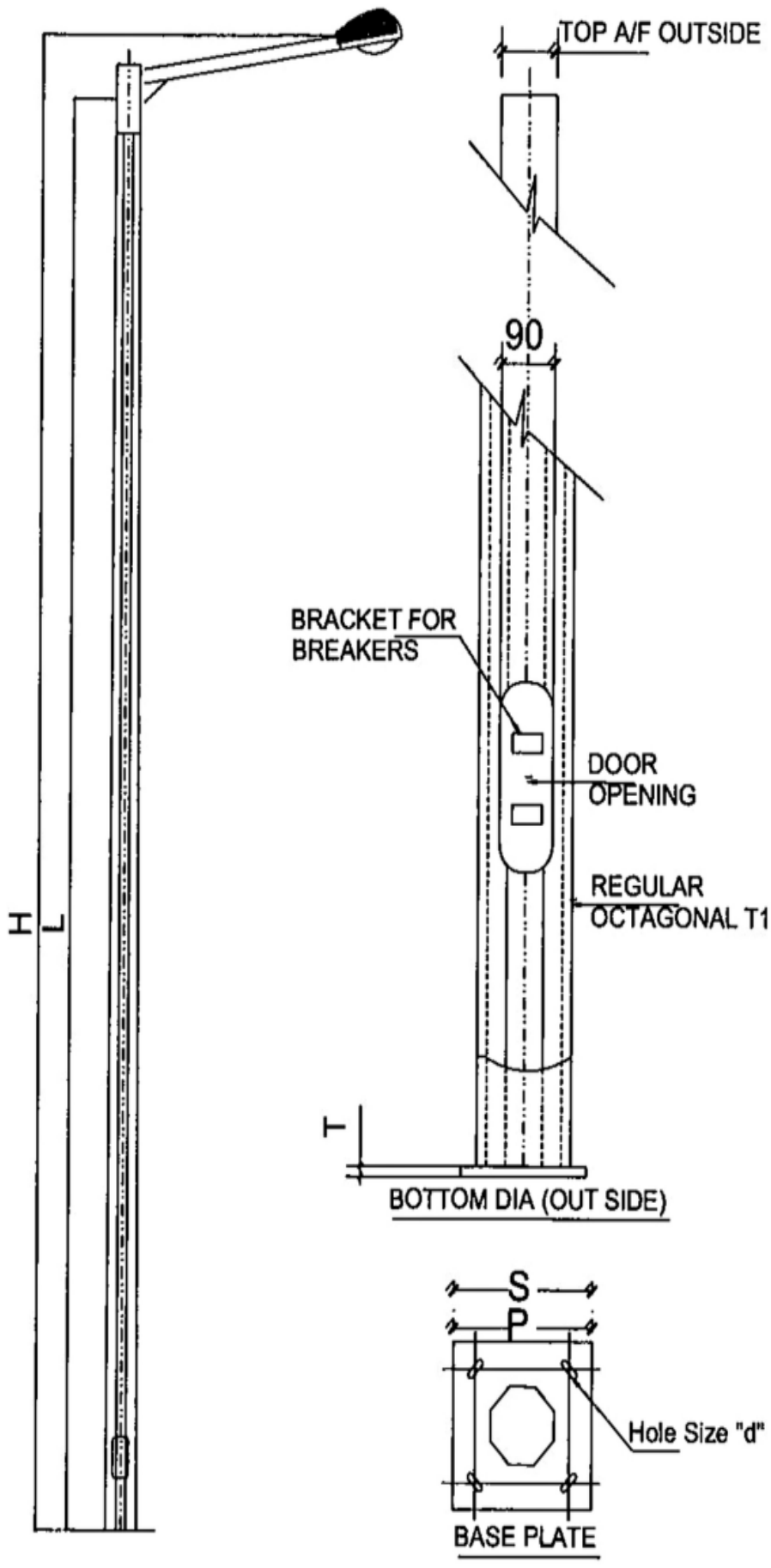
Bottom Dia (Outside)
Top A/F (Outside)
Arm Dia (Outside)

H = Total Height
T1 = Sheet Thickness
D = Door Opening
L = Shaft Length
S = Size Of BasePlate
T = Thickness Of Base Plar
d = Base Plate Holes For j
P = P.C.D Of Bolts

**FIGURE : 25-6**

**OCTAGONAL POLE DOUBLE ARM**

**(STREET LIGHTING)**




OCTAGONAL POLES

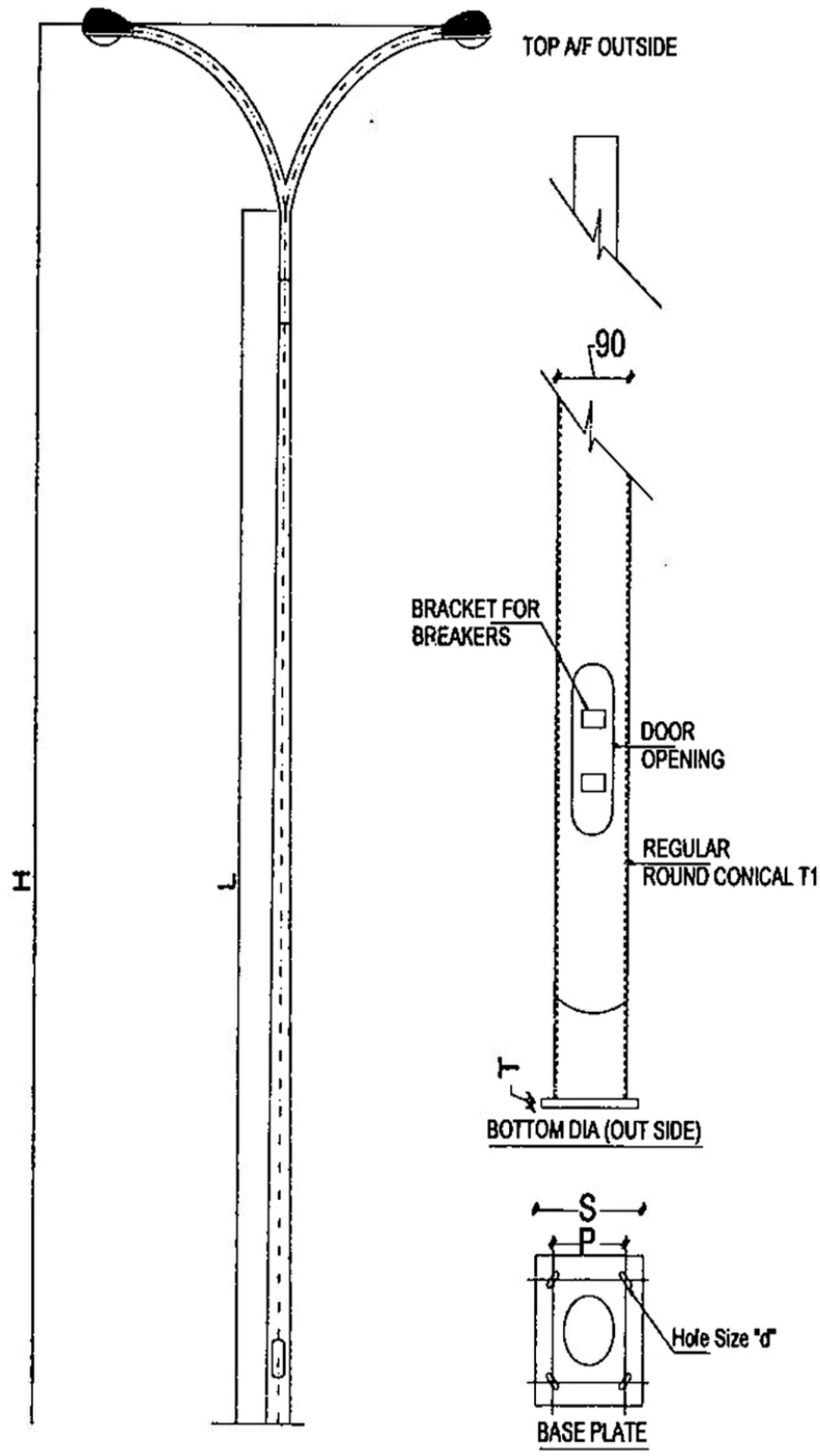
Bottom Dia (Outside)
Top A/F (Outside)
Arm Dia (Outside)

H = Total Height
T1 = Sheet Thickness
D = Door Opening
L = Shaft Length
S = Size Of BasePlate
T = Thickness Of Base Plate
d = Base Plate Holes For J Bolts
P = P.C.D Of Bolts

**FIGURE : 25-7**

**OCTAGONAL POLE SINGAL ARM**

(STREET LIGHTING)




ROUND CONICAL POLES

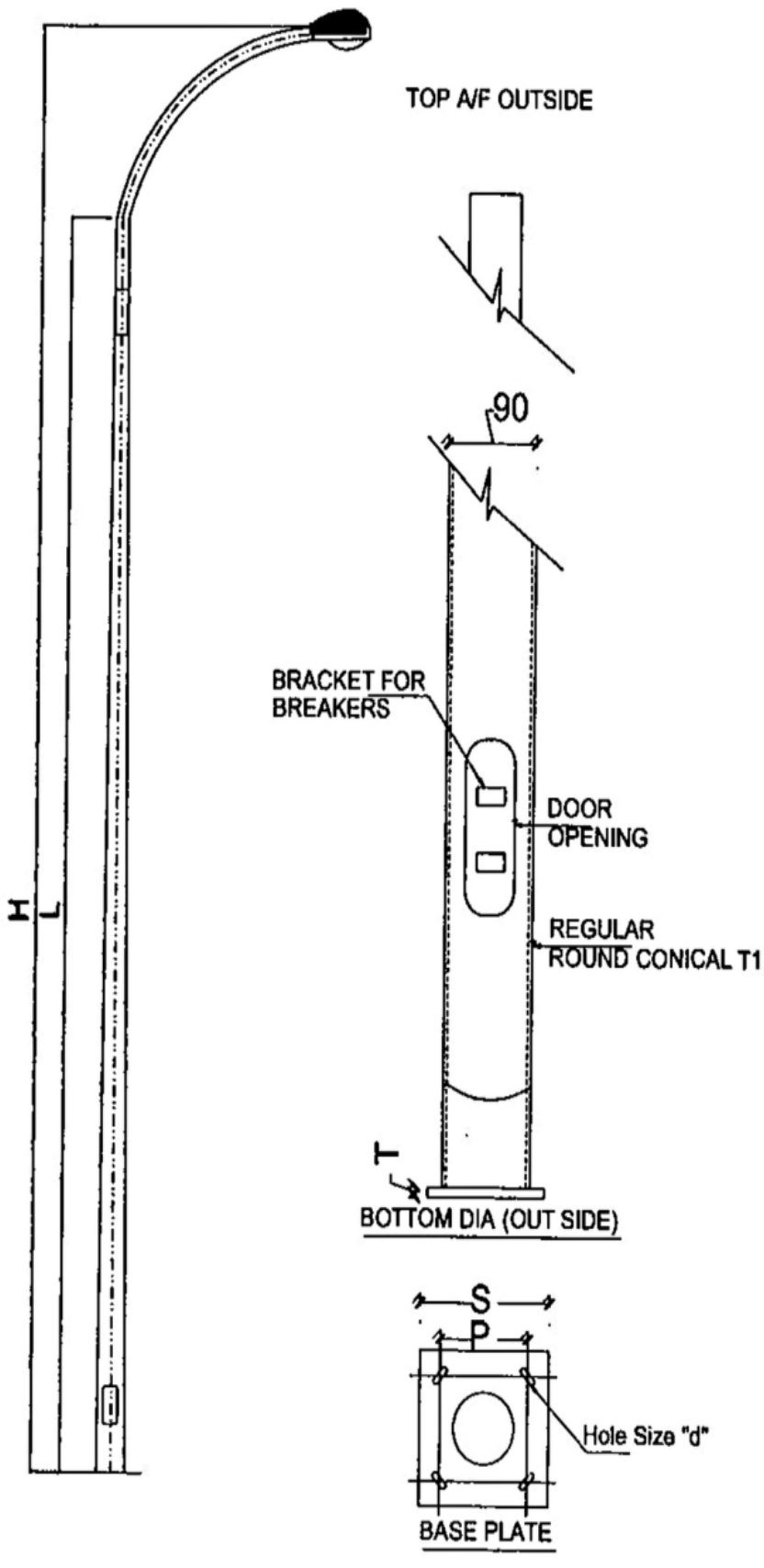
Bottom Dia (Outside)
Top A/F (Outside)
Arm Dia (Outside)

H = Total Height
T1 = Sheet Thickness
D = Door Opening
L = Shaft Length
S = Size Of BasePlate
T = Thickness Of Base Plante
d = Base Plate Holes For j Bolts
P = P.C.D Of Bolts

**FIGURE : 25-8**

**ROUND CONICAL POE DOUBLE ARM**

**(STREET LIGLHTING)**




ROUND CONICAL POLES

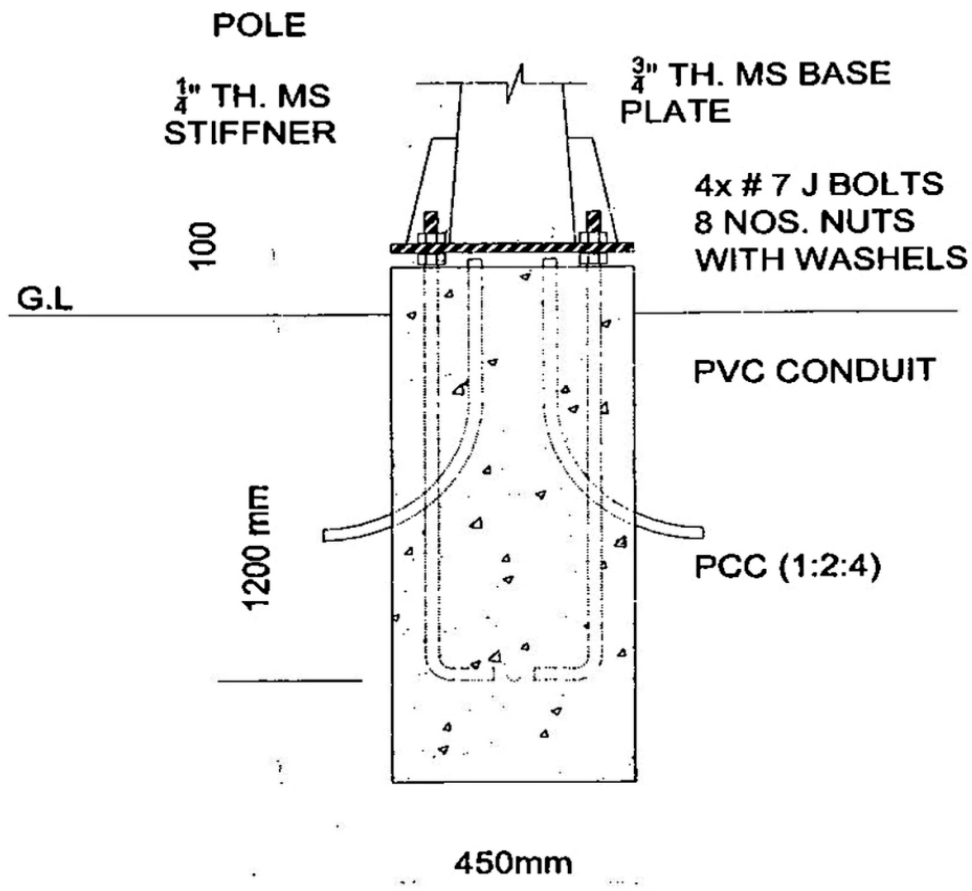
Bottom Dia (Outside)
Top A/F (Outside)
Arm Dia (Outside)

H = Total Height
T1 = Sheet Thickness
D = Door Opening
L = Shaft Length
S = Size Of BasePlate
T = Thickness Of Base Plante
d = Base Plate Holes For j Bolts
P = P.C.D Of Bolts

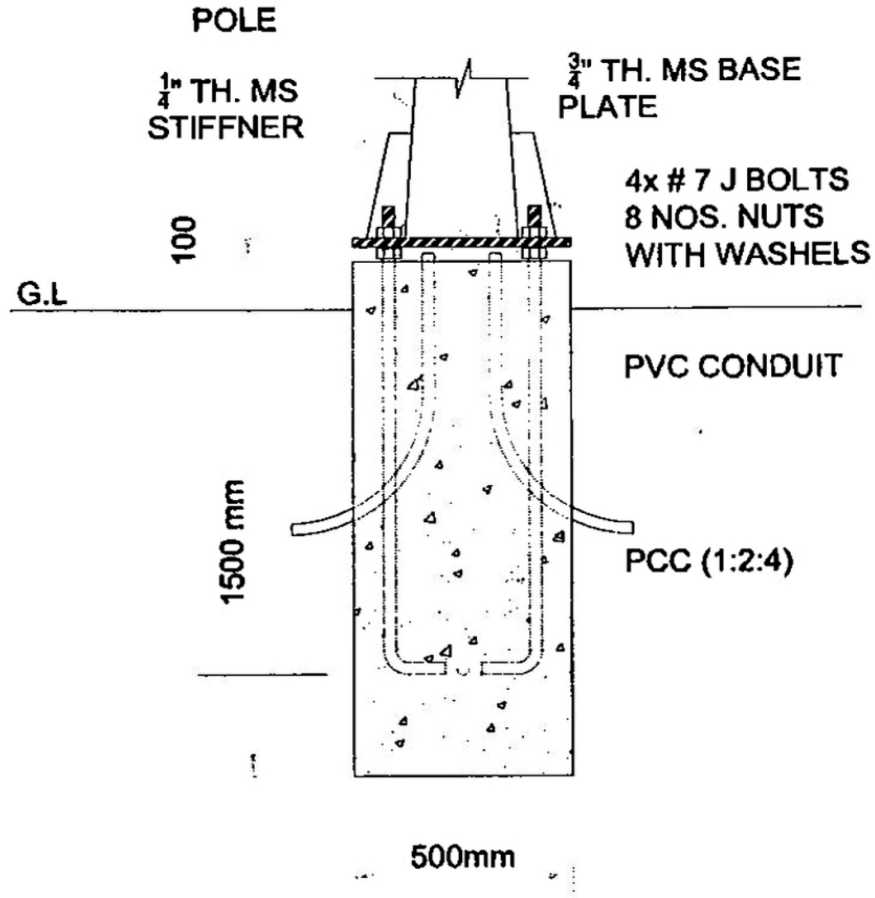
**FIGURE : 25-9**

**ROUND CONICAL POLE SINGAL ARM**

**{STREET LIGHTING)**




STREET LIGHT POLE (9M)
FOUNDATION




STREET LIGHT POLE (10M&12M)
FOUNDATION

**FIGURE: 25-10: POLE FOUNDATION**

**TABLE 25-9**

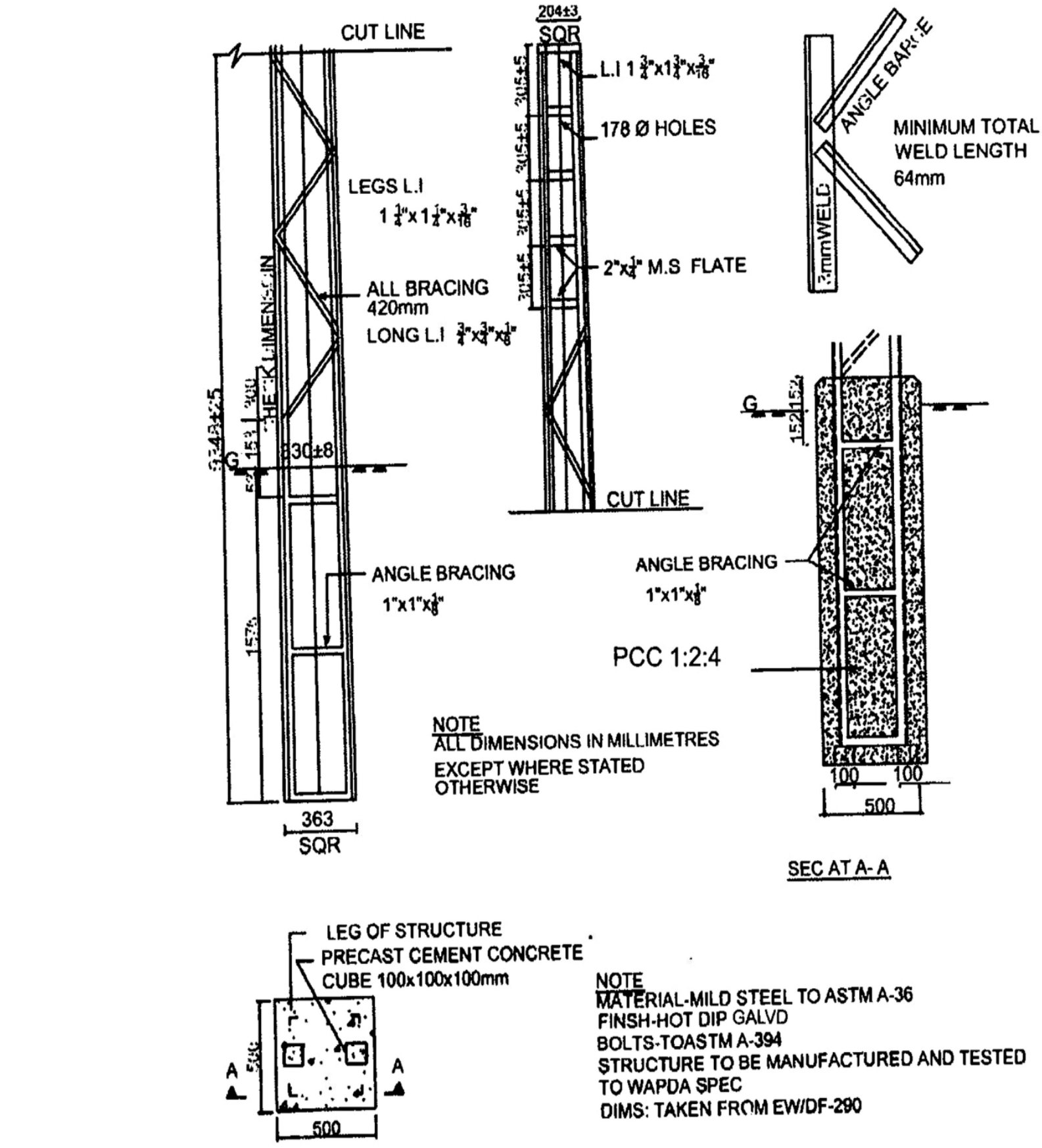
## G.I Round Conical Poles

| Type | Pole H | Bottom Dia {mm) | Top Dia {mm) | Door size LxW Mmxmm | Thickness (mm) | Shaft 'L' (mm) | Base plate (L **x W x** Thk) | Arm Dia X Thickness (mm) | Arm AL (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 9000 | 170 | 76 | 500 X90 | 4.00 | 8700 | 300 X300 X 20 | 60 X 6.25 | 500-1000 |
| 2 | 10000 | 180 | 76 | 500 X 90 | 4.00 | 9000 | 400 X400 X 20 | 60.4.00 | 1000 |
| 3 | 12000 | 205 | 90 | 500 X 90 | 4.5 | 12000 | 450 X450 X 20 | 60.4.00 | 12000 |

**TABLE 25-10**

## G.I Octagonal Poles

| Type | Pole H | Bottom Dia (mm) | Top Dia (mm) | Thickness (mm) | Shaft 'L' (mm) | Base plate (L x **W** x Thk) | Arm Dia X Thickness {mm) | Arm AL (mm) |
|---|---|---|---|---|---|---|---|---|
| 1 | 9000 | 170 | 60 | 4.00 | 8700 | 300 X300 X 20 | 60 | 500-1000 |
| 2 | 10000 | 225 | 100 | 4.50 | 9500 | 470X470X20 | 60. | 1000 |
| 3 | 12000 | 223 | 100 | 4.5 | 11500 | 470 X 470 X 20 | 60 | 1000 -1500 |




**FOUNDATION PLAN**

**FIGURE : 25-11**

**TYPE L, 31 FT 300 lbs LATTICED STEEL STRUCTURE (WAPDA Drg # PWD/ OF -10)**

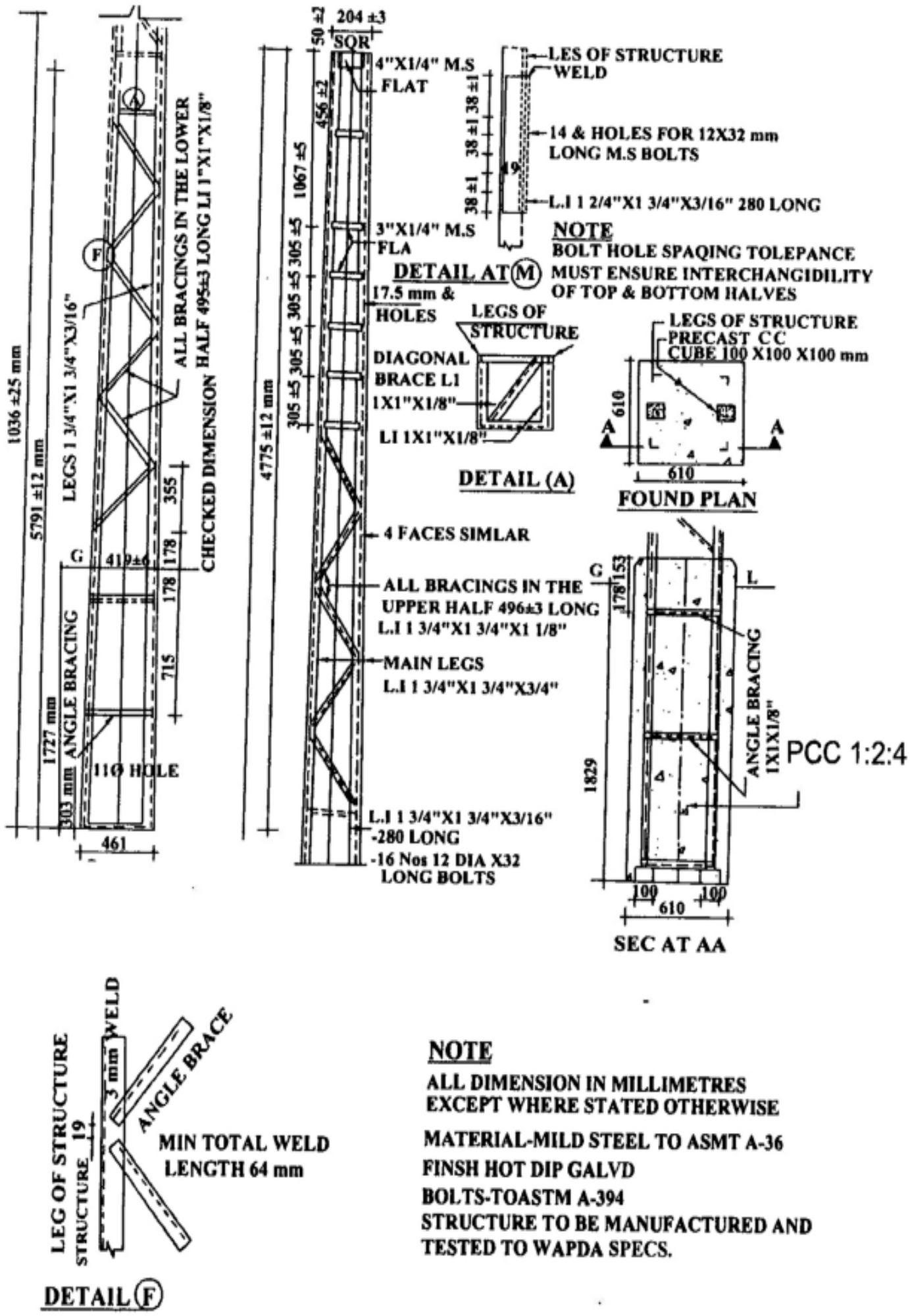


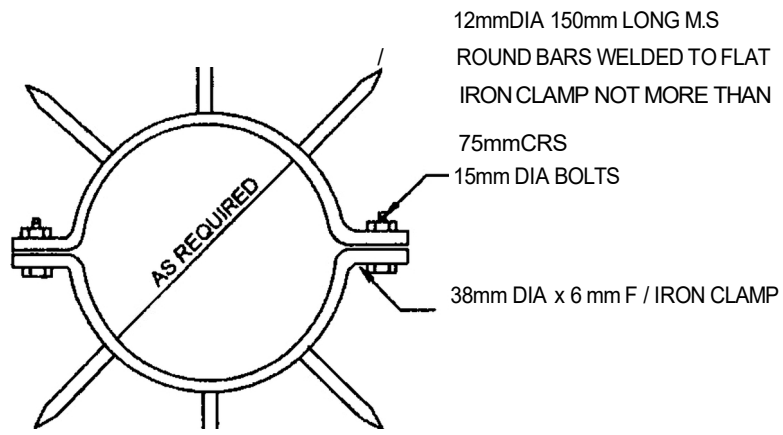

**FIGURE : 25-12**

**TYPE H, 35 FT 600 lbs LATTICED STEEL STRUCTURE**

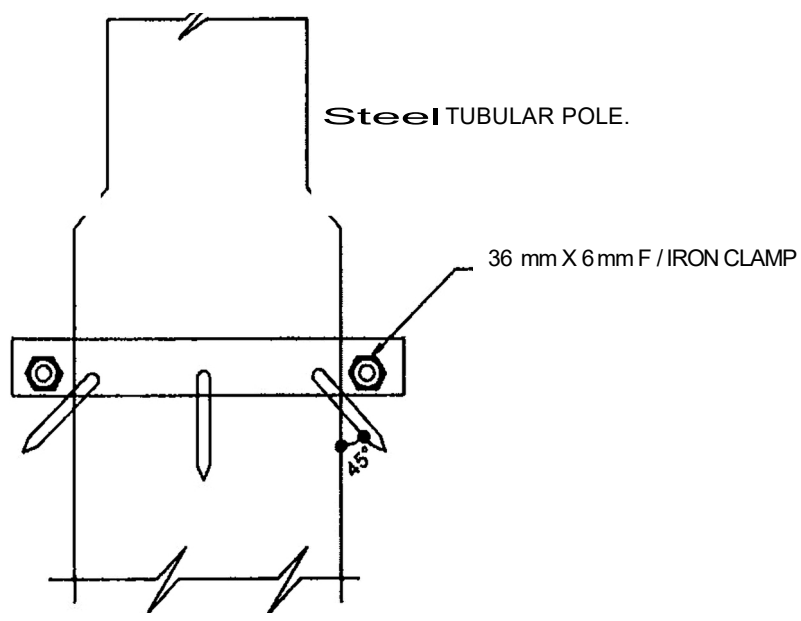
**(WAPDA Drg # PWD/ DF -11)**

# NON CLIMBABLE DEVICE

FOR ELECTRICAL POLE


12mmDIA 150mm LONG M.S
ROUND BARS WELDED TO FLAT
IRON CLAMP NOT MORE THAN
75mmCRS
15mm DIA BOLTS
AS REQUIRED
38mm DIA x 6 mm F / IRON CLAMP

PLAN

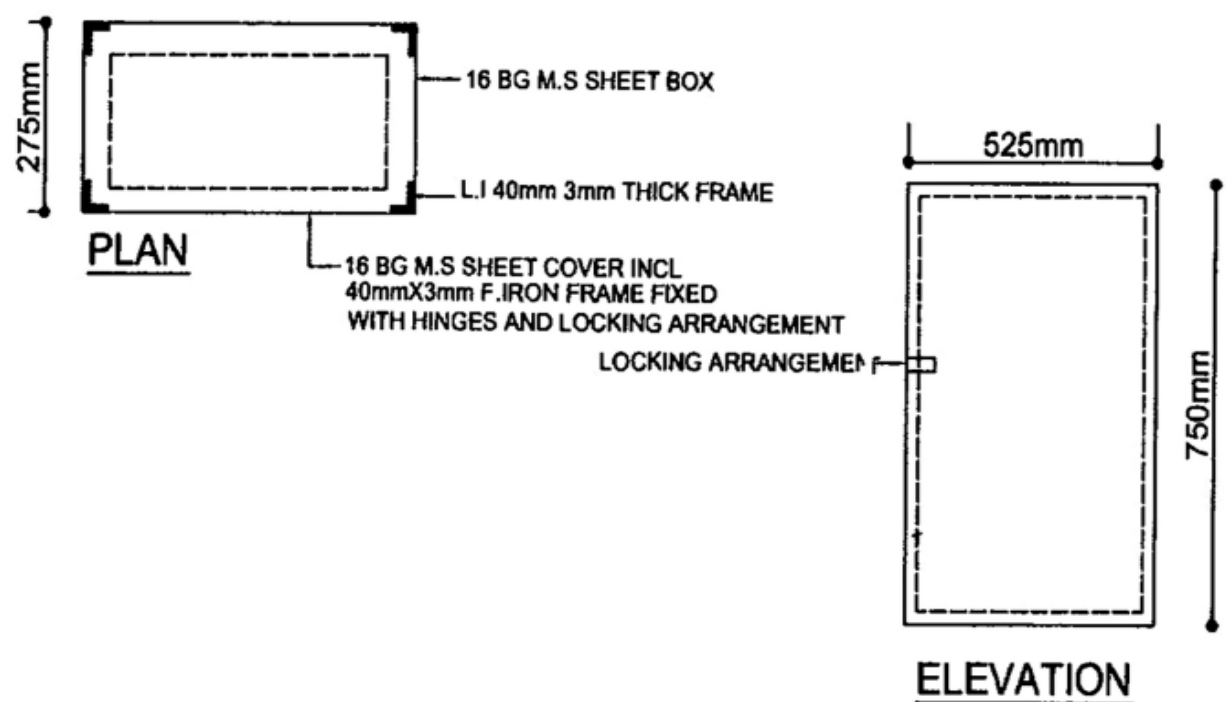



ELEVATION

FIGURE : 25-13

# BOX TYPE A

FOR MAIN SWITCH AND DISTRIBUTION BOARD OF OFFICERS QTRS




# BOX TYPE B

I) FOR METERS AND CUTOUTS OF OFFRS QTRS

II) FOR METERS AND CUTOUTS OF MAIN SWITCH AND DISTRIBUTION BOARDS OF JCO'S AND ORS QTRS

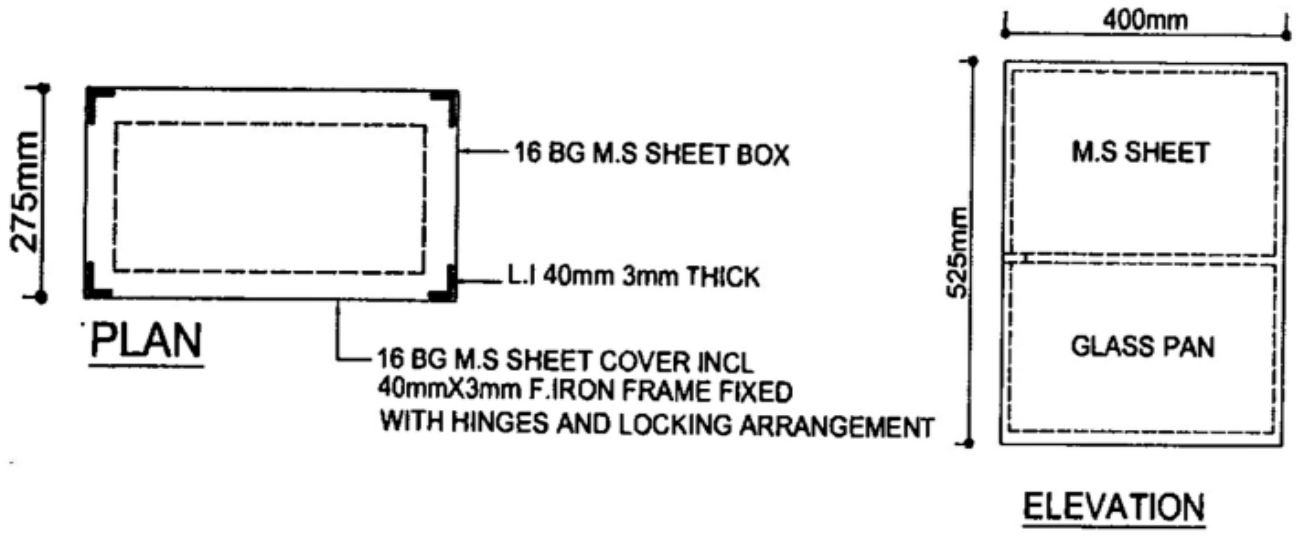



FIGURE : **25 14**

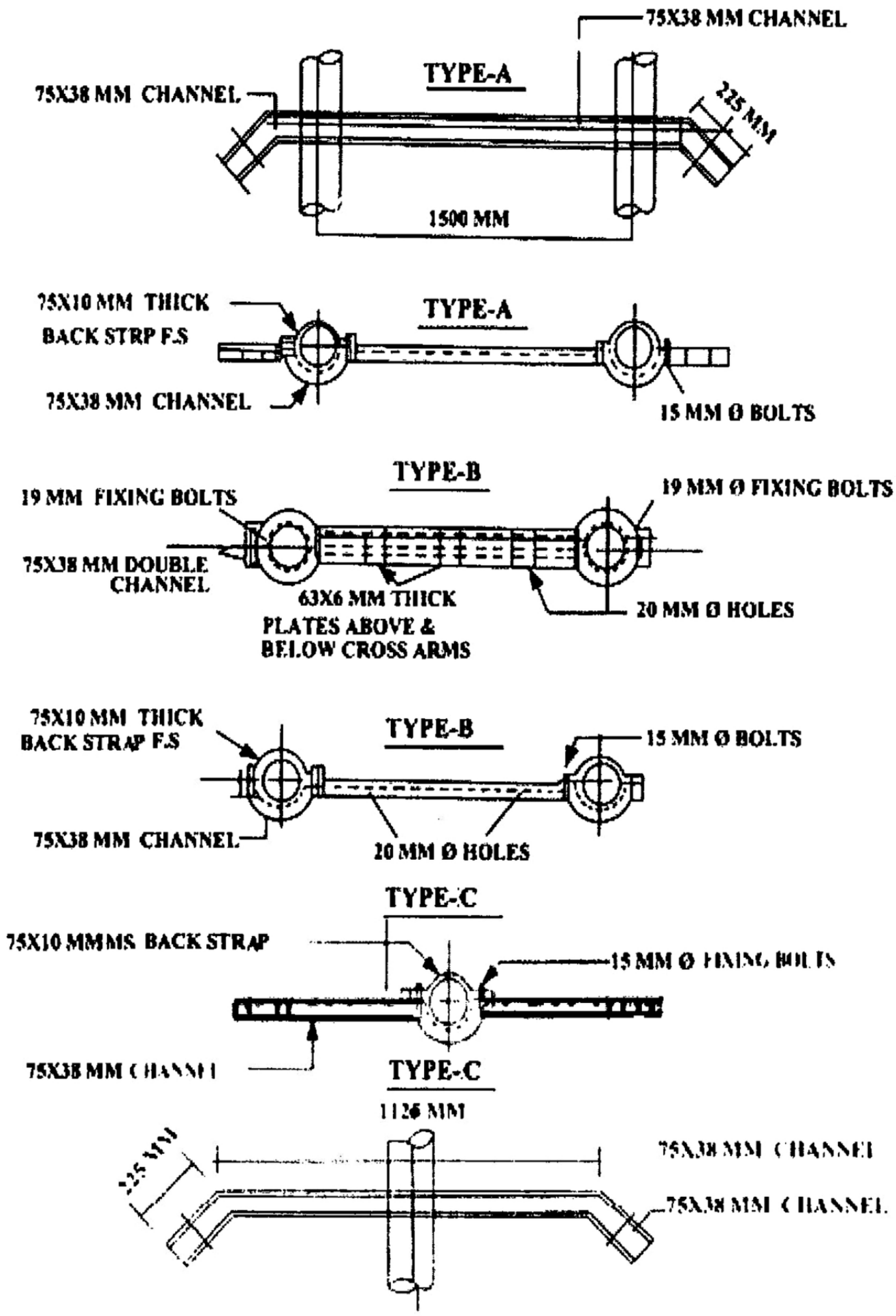
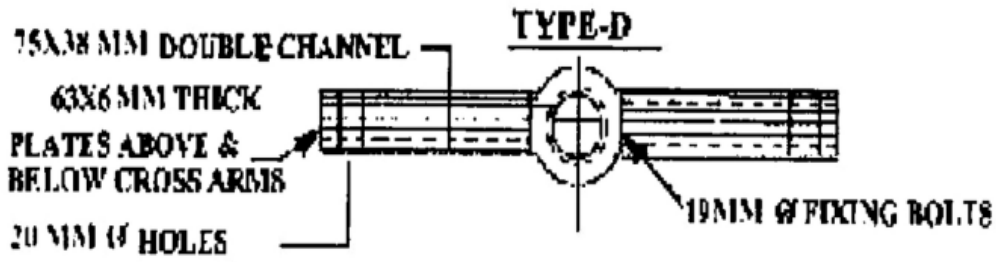
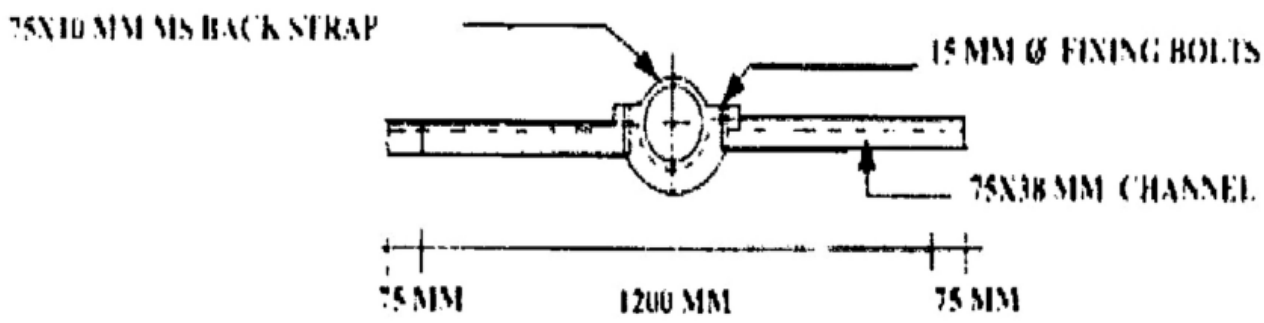
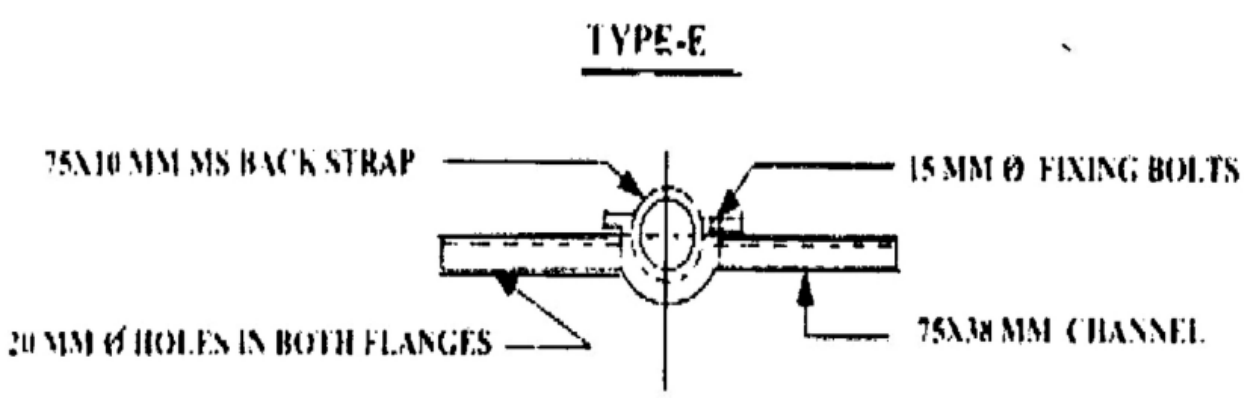


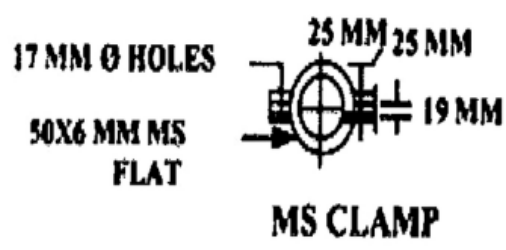

FIGURE: 25-15 TYPES OF CROSS ARMS

## Continued TYPES OF CROSS ARMS




MS CLAMP

MS CLAMP

## ITEM RATES

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Steel Tubular Pole** | | |
| 25-1 | Digging holes, in ordinary soil, provision and erection in position and setting in 150 mm thick PCC 1:4:8 foundation and 80 mm thick PCC 1:4:8, muffler all round for **Steel tubular un-galvanized pole 9 M long,** complete with base plate, as specified. | Each | 35963 |
| 25-2 | Same as item, 25-1, but **galvanized.** | Each | 46344 |
| 25-3 | Same as item 25-1, but 12 M long, **un-galvanized.** | Each | 49489 |
| 25-4 | Same as item 25-3, but 12 M long, **galvanized.** | Each | 64423 |
| 25-5 | Same as item 25-1 or 25-2, but fixing only. | Each | 6550 |
| 25-6 | Same as item 25-3 or 25-4, but fixing only. | Each | 7663 |
| 25-7 | Add to item 25-1, 25-2 or 25-5, if removal only. | Each | 1138 |
| 25-8 | Add to item 25-3, 25-4 or 25-6, if removal only. | Each | 1779 |
| 25-9 | Digging holes, in ordinary soil, provision and erections in position and setting in 150 mm thick PCC 1:4:8 foundation and 80 mm thick PCC 1:4:8 mufflers all round for steel tubular, un-galvanized, **single arm steel pole, 10.792 M long,** complete with base plate, as specified (figure 25-2). | Each | 41556 |
| 25-10 | Same as item 25-09, but **galvanized.** | Each | 47556 |
| 25-11 | Same as item 25-09, but double arm 10.792 M long, un-galvanized (Figure 25-3). | Each | 44372 |
| 25-12 | Same as item 25-09, but double arm 10.792 M long, **galvanized.** | Each | 51812 |
| 25-13 | Same as item 25-9 or 25-10, but fixing only. | Each | 6756 |
| 25-14 | Same as item 25-11 or 25-12, but fixing only. | Each | 7172 |
| 25-15 | Add to item 25-9, 25-10 or 25-13 but fixing only. | | 2079 |
| 25-16 | Add item 25-11, 25-12 or 25-14, if removal only. | Each | 2495 |
| 25-17 | Add to item 25-1 to 25-16 if fixing in hard soil. | Each | 228 |
| 25-18 | Add to item 25-1 to 25-16, if fixing in rock. | Each | 1670 |
| 25-19 | Digging holes, in ordinary soil, provision and erection in position and setting 150 mm thick PCC 1:2:4 foundation for Street Light pole but Round **conical** galvanized, 9 metre long, including "J" bolt set, single arm pole complete with base plate as specified (figure 25-9, 25-10). | Each | 57385 |
| 25-20 | Same as item 25-19, but Double Arm (figure 25-8, 25-10). | Each | 60985 |
| 25-21 | Digging holes, in ordinary soil, provision and erection in position and setting 150 mm thick PCC 1:2:4 foundation for Street Light pole but round **conical,** galvanized 10 metre long, including "J" bolt set, single arm pole complete with base plate as specified (figure 25-9, 25-10). | Each | 65785 |
| 25-22 | Same as item 25-21, but Double Arm (figure 25-8, 25-10). | Each | 69385 |
| 25-23 | Digging holes, in ordinary soil, provision and erection in position and setting 150 mm thick PCC 1:2:4 foundation for Street Light pole but round **conical,** galvanized, 12 metre long, including "J" bolt set, single arm pole complete with base plate as specified (figure 25-9, 25-10). | Each | 82945 |
| 25-24 | Same as item 25-23, but Double Arm (figure 25-8, 25-10). | Each | 85825 |
| 25-25 | Digging holes, in ordinary soil, provision and erection in position and setting 150 mm thick PCC 1:2:4 foundation for Street Light pole but **Octagonal,** galvanized, 9 metre long, including "J" bolt set, single arm pole complete with base plate as specified (figure 25-7, 25-10). | Each | 58333 |
| 25-26 | Same as item 25-25, but Double Arm (figure 25-6, 25-10). | Each | 59929 |
| 25-27 | Digging holes, in ordinary soil, provision and erection in position and setting 150 mm thick PCC 1:2:4 foundation for Street Light pole but **Octagonal,** galvanized, 10 metre long, including "J" bolt set, single arm pole complete with base plate as specified (figure 25-7, 25-10). | Each | 62089 |
| 25-28 | Same as item 25-27, but Double Arm (figure 25-6, 25-10). | Each | 73142 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-29 | Digging holes, in ordinary soil, provision and erection in position and setting 150 mm thick PCC 1:2:4 foundation for Street Light pole but **Octagonal,** galvanized, 12 meter long, including "J" bolt set, single arm pole complete with base plate as specified (figure 25-7, 25-10). | Each | 80905 |
| 25-30 | Same as item 25-29, but Double Arm (figure 25-6, 25-10). | Each | 83905 |
| 25-31 | Same as item 25-19, 25-25 but fixing only. | Each | 6985 |
| 25-32 | Same as item 25-20, 25-26 but fixing only. | Each | 6985 |
| 25-33 | Same as item 25-21, 25-27 but fixing only. | Each | 6985 |
| 25-34 | Same as item 25-22 or 25-28 but fixing only. | Each | 6985 |
| 25-35 | Same as item 25-23 or 25-29 but fixing only. | Each | 6985 |
| 25-36 | Same as item 25-24 or 25-30 but fixing only. | Each | 6985 |
| 25-37 | Add to item 25-19, 25-25 or 25-31 if removal only. | Each | 2079 |
| 25-38 | Add to item 25-20, 25-26 or 25-32 if removal only. | Each | 2079 |
| 25-39 | Add to item 25-21, 25-27 or 25-33 if removal only. | Each | 2079 |
| 25-40 | Add to item 25-22, 25-28 or 25-34 if removal only. | Each | 2079 |
| 25-41 | Add to item 25-23, 25-29 or 25-35 if removal only. | Each | 2079 |
| 25-42 | Add to item 25-24, 25-30 or 25-36 if removal only. | Each | 2079 |
| | **"L" Type Lattice Steel Pole** | | |
| 25-43 | Digging hole, in ordinary soil, provision and erection of "L"- Type Lattice Steel pole, un-galvanized, including provision of PCC 1:2:4, all as per WAPDA Drawing No. PDW/DF-10 (figure 25-11). | Each | 29697 |
| 25-44 | Same as item 25-43, but **galvanized.** | Each | 35097 |
| 25-45 | Same as item 25-43 or 25-44, but fixing only. | Each | 6297 |
| 25-46 | Add to item 25-43, 25-44 or 25-45, if removal only. | Each | 2079 |
| 25-47 | Add to item 25-43 to 25-46, if fixed in hard soil. | Each | 228 |
| 25-48 | Add to item 25-43 to 25-46, if fixed in rock. | Each | 1670 |
| | **"H" Type Lattice Steel Pole** | | |
| 25-49 | Digging hole in ordinary soil, provision and erection of **"H" Type Lattice Steel pole,** un-galvanized, including provision of PCC 1:2:4, all as per WAPDA Drawing no. PDW/DF 11 (figure 25-12). | Each | 42444 |
| 25-50 | Same as item 25-49, but **galvanized.** | Each | 47244 |
| 25-51 | Same as item 25-49 or 25-50, but fixing only. | Each | 8844 |
| 25-52 | Add to item 25-49 to 25-50, 25-51 if removal only. | Each | 2079 |
| 25-53 | Add to item 25-49 to 25-51, if fixed in hard soil. | Each | 228 |
| 25-54 | Add to item 25-49 to 25-51, if fixed in rock. | Each | 1670 |
| 25-55 | Digging hole in ordinary soil, provision and erection of **"H" Type Lattice Steel pole 45 ft,** un-galvanized, including provision of. PCC 1:2:4, all as specified. | Each | 120756 |
| 25-56 | Same as item 25-55, but **galvanized.** | Each | 136200 |
| 25-57 | Same as item 25-55 or 25-56, but fixing only. | Each | 16860 |
| 25-58 | Add to item 25-55 to 25-56, if removal only. | Each | 4568 |
| 25-59 | Add to item 25-55 to 25-57, if fixed in hard soil. | Each | 270 |
| 25-60 | Add to item 25-55 to 25-57, if fixed in rock. | Each | 3000 |
| | **Cross Arm** | | |
| 25-61 | Cross arms galvanized channels iron with clamp, washers, bolts and nuts etc Type **"A",** supply and fixing (figure 25-15). | Each | 4489 |
| 25-62 | Same as item 25-61, but Type **'B'.** | Each | 4047 |
| 25-63 | Same as item 25-61, but Type **•C•.** | Each | 3687 |
| 25-64 | Same as item 25-61, but Type **'D'.** | Each | 2586 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-65 | Same as item 25-61, but Type **'E'.** | Each | 1397 |
| 25-66 | Same as item 25-61, but 610 mm (for service bracket). | Each | 1345 |
| 25-67 | Same as item 25-61, but fixing only. | Each | 409 |
| 25-68 | Same as item 25-62 or 25-63, but fixing only. | Each | 327 |
| 25-69 | Same as item 25-64, 25-65 or 25-66, but fixing only. | Each | 205 |
| 25-70 | Add to item 25-61 to 25-63 or 25-67 to 25-68, if removal only. | Each | 327 |
| 25-71 | Add to item 25-64 to 25-66 or 25-69, if removal only. | Each | 205 |
| 25-72 | **Wooden Cross Arm,** 2.44 M x 125 mm x 100 mm, complete with bracket and bolt/nuts, oil dipped, as specified for HT, supply and fixing. | Each | 3032 |
| 25-73 | Same as item 25-72, but fixing only. | Each | 512 |
| 25-74 | Add to item 25-72 or 25-73, if removal only. | Each | 512 |
| | **Painting** | | |
| 25-75 | Painting of steel pole, tubular and other type, excluding cross arms up to 12 M long, including anti corrosive paint, first coat, (new or old work). | Each | 1084 |
| 25-76 | Same as item 25-75, but without anti corrosive paint. | Each | 716 |
| 25-77 | Same as item 25-75, for second and subsequent coat, new or old work. | Each | 534 |
| 25-78 | Same as item 25-76, for second and subsequent coat, new or old work. | Each | 506 |
| 25-79 | Painting of service pole, first coat, (new or old work}. | Each | 411 |
| 25-80 | Same as item 25-79, for second and subsequent coat, (new or old work). | Each | 355 |
| | **Aerial Lines / Overhead Lines Insulators** | | |
| 25-81 | Insulators, pin type LT, complete with pin, nuts and washers, supply and fixing. | Each | 423 |
| 25-82 | Same as item 25-81, but for HT upto 11 KV. | Each | 991 |
| 25-83 | Insulator shackle, complete with "D" iron or suitable arrangements /strap, LT, supply and fixing. | Each | 516 |
| 25-84 | Disc insulator HT, complete with pin, nuts washers etc, 11 KV, supply and fixing. | Each | 1767 |
| 25-85 | Double Disc insulator HT, complete with pin etc, 11 KV, supply and fixing. | Each | 2809 |
| 25-86 | Same as item 25-81, but fixing only. | Each | 123 |
| 25-87 | Same as item 25-82, but fixing only. | Each | 164 |
| 25-88 | Same as item 25-83, but fixing only. | Each | 204 |
| 25-89 | Same as item 25-84, but fixing only. | Each | 327 |
| 25-90 | Same as item 25-85, but fixing only. | Each | 409 |
| 25-91 | Add to item 25-81 or 25-86, if removal only. | Each | 93 |
| 25-92 | Add to item 25-82, 25-83, 25-87 or 25-88, if removal only. | Each | 163 |
| 25-93 | Add to item 25-84, 25-85, 25-89 or 25-90, if removal only. | Each | 327 |
| | **Stays** | | |
| 25-94 | Provision and fixing of stay assembly, stay wire (7/10 SWG), stay clamps, insulated including setting in earth, with PCC 1:3:6, complete, upto 13.75 M length. | Each | 6508 |
| 25-95 | Provision and fixing of stay flying, complete with stay wire (7/10 SWG), stay assembly, stay clamps, upto 15 M length. | Each | 6219 |
| 25-96 | Same as item 25-94, but fixing only. | Each | 2668 |
| 25-97 | Same as item 25-94, but fixing only. | Each | 2668 |
| 25-98 | Add to item 25-94 to 25-97, if removal only. | Each | 1023 |
| | **Copper Conductor** | | |
| 25-99 | Stringing, straining, tensioning and binding **Copper conductor,** bare solid or stranded 10 SWG, supply and fixing. | Metre | 137 |
| 25-100 | Same as item 25-99, but 8 SWG. | Metre | 193 |

| Sl No. | Description | Unit | Rate (Rs) j |
|---|---|---|---|
| 25-101 | Same as item 25-99, but 6 SWG. | Metre | 267 |
| 25-102 | Same as item 25-99, but 4 SWG. | Metre | 369 |
| 25-103 | Same as item 25-99, but 2 SWG. | Metre | 501 |
| 25-104 | Same as item 25-99, but 1 SWG. | Metre | 586 |
| 25-105 | Same as item 25-99, but 1/0 SWG. | Metre | 669 |
| 25-106 | Same as item 25-99, but 2/0 SWG. | Metre | 779 |
| 25-107 | Same as item 25-99, but 3/0 SWG. | Metre | 895 |
| 25-108 | Same as item 25-99, but 4/0 SWG. | Metre | 1023 |
| 25-109 | Same as item 25-99, but 70 $mm^2$. | Metre | 909 |
| 25-110 | Same as item 25-99, but 95 $mm^2$. | Metre | 1258 |
| 25-111 | Same as item 25-99, but 120 $mm^2$. | Metre | 1527 |
| 25-112 | Same as item 25-99, but 150 $mm^2$. | Metre | 1888 |
| 25-113 | Same as item 25-99, but **MS,** medium drawn galvanized wire, 10 SWG. | Metre | 87 |
| 25-114 | Same as item 25-113, but 8 SWG. | Metre | 105 |
| 25-115 | Same as item 25-113, but 6 SWG. | Metre | 132 |
| | **Aluminium Conductor** | | |
| 25-116 | Stringing, straining, tensioning and binding, **Aluminium Conductor Steel Reinforced (ACSR)** 6/0.083 aluminium and 1/0.083 steel **(Squirrel),** supply and fixing. | Metre | 121 |
| 25-117 | Same as item 25-116 but size 6/.132 aluminium and 1/.132 steel **(Rabbit).** | Metre | 171 |
| 25-118 | Same as item 25-116, but size 6/.183 aluminium and 1/.183 steel **(Dog).** | Metre | 296 |
| 25-119 | Same as item 25-99 to 25-103, but fixing only. | Metre | 74 |
| 25-120 | Same as item 25-104 to 25-106, but fixing only. | Metre | 102 |
| 25-121 | Same as item 25-107 to 25-112, but fixing only. | Metre | 147 |
| 25-122 | Same as item 25-113 to 25-115, but fixing only. | Metre | 57 |
| 25-123 | Same as item 25-116 to 25-118, but fixing only. | Metre | 123 |
| 25-124 | Add to item 25-99 to 25-103 or 25-119, if removal only. | Metre | 73 |
| 25-125 | Add to item 25-104 to 25-106 or 25-120, if removal only. | Metre | 102 |
| 25-126 | Add to item 25-107 to 25-112 or 25-121, if removal only. | Metre | 147 |
| 25-127 | Add to item 25-113 to 25-115 or 25-122, if removal only. | Metre | 57 |
| 25-128 | Add to item 25-116 to 25-118 or 25-123, if removal only. | Metre | 123 |
| | **Cable Electric aluminium • HT (3 core)** | | |
| 25-129 | Cable electric HT, 11 KV stranded aluminium conductor, XLPE insulated, extruded, PVC bedded, steel wire armoured and PVC sheathed overall 3 core, 16 $mm^2$, laid in trenches complete with bricks, sand (excluding cost of excavation), supply and fixing. | Metre | 1991 |
| 25-130 | Same as item 25-129, but 25 $mm^2$. | Metre | 2227 |
| 25-131 | Same as item 25-129, but 35 $mm^2$. | Metre | 2362 |
| 25-132 | Same as item 25-129, but 50 $mm^2$. | Metre | 2610 |
| 25-133 | Same as item 25-129, but 70 $mm^2$. | Metre | 2916 |
| 25-134 | Same as item 25-129, but 95 $mm^2$. | Metre | 3300 |
| 25-135 | Same as item 25-129, but 120 $mm^2$. | Metre | 3623 |
| 25-136 | Same as item 25-129, but 150 $mm^2$. | Metre | 4216 |
| 25-137 | Same as item 25-129, but 185 $mm^2$. | Metre | 4633 |
| 25-138 | Same as item 25-129, but 240 $mm^2$. | Metre | 5234 |
| 25-139 | Same as item 25-129, but 300 $mm^2$. | Metre | 5898 |
| 25-140 | **Cable electric** HT, 11 KV stranded aluminium conductor XLPE insulated, extruded PVC bedded, steel wire armoured and PVC sheathed overall, | Metre | 1716 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | 3 core 16 mm$^2$ laid in **GI/RCC Pipe/duct** (excluding cost of pipe/duct), supply and fixing. | | |
| 25-141 | Same as item 25-140, but 25 mm$^2$. | Metre | 1941 |
| 25-142 | Same as item 25-140, but 35 mm$^2$. | Metre | 2065 |
| 25-143 | Same as item 25-140, but 50 mm$^2$. | Metre | 2280 |
| 25-144 | Same as item 25-140, but 70 mm$^2$. | Metre | 2586 |
| 25-145 | Same as item 25-140, but 95 mm$^2$. | Metre | 2971 |
| 25-146 | Same as item 25-140, but 120 mm$^2$. | Metre | 3293 |
| 25-147 | Same as item 25-140, but 150 mm$^2$. | Metre | 3872 |
| 25-148 | Same as item 25-140, but 185 mm$^2$. | Metre | 4288 |
| 25-149 | Same as item 25-140, but 240 mm$^2$. | Metre | 4890 |
| 25-150 | Same as item 25-140, but 300 mm$^2$. | Metre | 5554 |
| 25-151 | Same as item 25-129 to 25-139 but fixing only. | Metre | 404 |
| 25-152 | Same as item 25-140 to 25-150, but fixing only. | Metre | 74 |
| 25-153 | Add to item 25-129 to 25-139, or 25-151, if removal only. | Metre | 83 |
| 25-154 | Add to item 25-140 to 25-150, or 25-152, if removal only. | Metre | 74 |
| | **Cable Electric aluminium - HT (Single core) aluminium conductor** | | |
| 25-155 | Cable electric HT 11 KV stranded aluminium conductor XLPE insulated, extruded PVC bedded, steel wire armoured and PVC sheathed overall single core, 25 mm$^2$ laid in trenches complete with bricks, sand ( excluding cost of excavation) supply and fixing. | Metre | 888 |
| 25-156 | Same as item 25-155, but 35 mm$^2$. | Metre | 921 |
| 25-157 | Same as item 25-155, but 50 mm$^2$. | Metre | 985 |
| 25-158 | Same as item 25-155, but 70 mm$^2$. | Metre | 1059 |
| 25-159 | Same as item 25-155, but 95 mm$^2$. | Metre | 1209 |
| 25-160 | Same as item 25-155, but 120 mm$^2$. | Metre | 1284 |
| 25-161 | Same as item 25-155, but 150 mm$^2$. | Metre | 1386 |
| 25-162 | Same as item 25-155, but 185 mm$^2$. | Metre | 1515 |
| 25-163 | Same as item 25-155, but 240 mm$^2$. | Metre | 1684 |
| 25-164 | Same as item 25-155, but 300 mm$^2$. | Metre | 1865 |
| 25-165 | Cable electric HT, 11 KV stranded aluminium conductor XLPE insulated, extruded PVC bedded, steel wire-armoured and PVC sheathed overall Single core, 25 mm$^2$ Laid in *GI/*RCC pipe/duct (excluding cost of pipe/duct), supply and fixing. | Metre | 577 |
| 25-166 | Same as item 25-165, but 35 mm$^2$. | Metre | 610 |
| 25-167 | Same as item 25-165, but 50 mm$^2$. | Metre | 673 |
| 25-168 | Same as item 25-165, but 70 mm$^2$. | Metre | 754 |
| 25-169 | Same as item 25-165, but 95 mm$^2$. | Metre | 904 |
| 25-170 | Same as item 25-165, but 120 mm$^2$. | Metre | 993 |
| 25-171 | Same as item 25-165, but 150 mm$^2$. | Metre | 1086 |
| 25-172 | Same as item 25-165, but 185 mm$^2$. | Metre | 1210 |
| 25-173 | Same as item 25-165, but 240 mm$^2$. | Metre | 1379 |
| 25-174 | Same as item 25-165, but 300 mm$^2$. | Metre | 1560 |
| 25-175 | Same as item 25-155 to 25-164, but fixing only. | Metre | 360 |
| 25-176 | Same as item 25-165 to 25-174, but fixing only. | Metre | 74 |
| 25-177 | Add to item 25-155 to 25-164 or 25-175, if removal only. | Metre | 49 |
| 25-178 | Add to item 25-165 to 25-174 or 25-176, if removal only. | Metre | 41 |

| 51 No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Cable Electric Copper - HT (3 core)** | | |
| 25-179 | **Cable electric** HT, 11 KV stranded **copper conductor,** XLPE insulated, extruded, PVC bedded **steel wire armoured** and PVC sheathed overall, 3 core 16 $mm^2$ laid in trenches complete with **bricks, sand,** (excluding cost of excavation), supply and fixing. | Metre | 2658 |
| 25-180 | Same as item 25-179, but 3 core, 25 $mm^2$. | Metre | 3290 |
| 25-181 | Same as item 25-179, but 3 core, 35 $mm^2$. | Metre | 3865 |
| 25-182 | Same as item 25-179, but 3 core, 50 $mm^2$. | Metre | 4633 |
| 25-183 | Same as item 25-179, but 3 core, 70 $mm^2$. | Metre | 5870 |
| 25-184 | Same as item 25-179, but 3 core, 95 $mm^2$. | Metre | 7422 |
| 25-185 | Same as item 25-179, but 3 core, 120 $mm^2$. | Metre | 8868 |
| 25-186 | Same as item 25-179, but 3 core, 150 $mm^2$. | Metre | 10661 |
| 25-187 | Same as item 25-179, but 3 core, 185 $mm^2$. | Metre | 13259 |
| 25-188 | Same as item 25-179, but 3 core, 240 $mm^2$. | Metre | 15899 |
| 25-189 | Same as item 25-179, but 3 core, 300 $mm^2$. | Metre | 19295 |
| 25-190 | Cable electric HT, 11 KV stranded copper conductor XLPE insulated, extruded, PVC bedded, **steel wire armoured** and PVC sheathed overall, 3 core, 16 $mm^2$ laid in GI / **RCC pipe/ duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 2343 |
| 25-191 | Same as item 25-190, but 3 core, 25 $mm^2$. | Metre | 2981 |
| 25-192 | Same as item 25-190, but 3 core, 35 $mm^2$. | Metre | 3543 |
| 25-193 | Same as item 25-190, but 3 core, 50 $mm^2$. | Metre | 4309 |
| 25-194 | Same as item 25-190, but 3 core, 70 $mm^2$. | Metre | 5545 |
| 25-195 | Same as item 25-190, but 3 core, 95 $mm^2$. | Metre | 7106 |
| 25-196 | Same as item 25-190, but 3 core, 120 $mm^2$. | Metre | 8538 |
| 25-197 | Same as item 25-190, but 3 core, 150 $mm^2$. | Metre | 10316 |
| 25-198 | Same as item 25-190, but 3 core, 185 $mm^2$. | Metre | 12476 |
| 25-199 | Same as item 25-190, but 3 core, 240 $mm^2$. | Metre | 15555 |
| 25-200 | Same as item 25-190, but 3 core, 300 $mm^2$. | Metre | 18984 |
| 25-201 | Same as item 25-179 to 25-189, but fixing only. | Metre | 404 |
| 25-202 | Same as item 25-190 to 25-200, but fixing only. | Metre | 74 |
| 25-203 | Add to item 25-179 to 25-189, or 25-201, if removal only. | Metre | 83 |
| 25-204 | Add to item 25-190 to 25-200, or 25-202, if removal only. | Metre | 74 |
| | **Cable Electric Copper - HT (Single core)** | | |
| 25-205 | Cable electric HT, 11 KV stranded Copper conductor XLPE insulated, extruded PVC bedded, **sb el wire armoured** and PVC sheathed overall Single core, 16 $mm^2$ laid in trenches complete with bricks, sand (excluding cost of excavation) supply and fixing. | Metre | 1153 |
| 25-206 | Same as item 25-205, but 25 $mm^2$. | Metre | 1244 |
| 25-207 | Same as item 25-205, but 35 $mm^2$. | Metre | 1415 |
| 25-208 | Same as item 25-205, but 50 $mm^2$. | Metre | 1634 |
| 25-209 | Same as item 25-205, but 70 $mm^2$. | Metre | 2045 |
| 25-210 | Same as item 25-205, but 95 $mm^2$. | Metre | 2570 |
| 25-211 | Same as item 25-205, but 120 $mm^2$. | Metre | 3020 |
| 25-212 | Same as item 25-205, but 150 $mm^2$. | Metre | 3509 |
| 25-213 | Same as item 25-205, but 185 $mm^2$. | Metre | 4174 |
| 25-214 | Same as item 25-205, but 240 $mm^2$. | Metre | 5178 |
| 25-215 | Same as item 25-205, but 300 $mm^2$. | Metre | 6258 |
| 25-216 | Cable electric HT, 11 KV stranded copper conductor, XLPE insulated, | Metre | 854 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | extruded, PVC bedded, **steel wire armoured** and PVC sheathed overall, Single core, 16 $mm^2$ Laid in **GI/ RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | | |
| 25-217 | Same as item 25-216, but 25 $mm^2$. | Metre | 933 |
| 25-218 | Same as item 25-216, but 35 $mm^2$. | Metre | 1107 |
| 25-219 | Same as item 25-216, but 50 $mm^2$. | Metre | 1348 |
| 25-220 | Same as item 25-216, but 70 $mm^2$. | Metre | 1734 |
| 25-221 | Same as item 25-216, but 95 $mm^2$. | Metre | 2265 |
| 25-222 | Same as item 25-216, but 120 $mm^2$. | Metre | 2715 |
| 25-223 | Same as item 25-216, but 150 $mm^2$. | Metre | 3204 |
| 25-224 | Same as item 25-216, but 185 $mm^2$. | Metre | 3869 |
| 25-225 | Same as item 25-216, but 240 $mm^2$. | Metre | 4878 |
| 25-226 | Same as item 25-216, but 300 $mm^2$. | Metre | 5953 |
| 25-227 | Same as item 25-205 to 25-215, but fixing only. | Metre | 379 |
| 25-228 | Same as item 25-216 to 25-226, but fixing only. | Metre | 74 |
| 25-229 | Add to item 25-205 to 25-215 or 25-227, if removal only. | Metre | 60 |
| 25-230 | Add to item 25-216 to 25-226 or 25-228, if removal only. | Metre | 74 |
| | **Cable Electric - LT 4 Core** | | |
| 25-231 | **Cable electric** LT PVC insulated, PVC sheathed, **steel wire armoured,** overall PVC 600/1000 V, with stranded **copper conductor,** 16 $mm^2$, 4 core, laid in trenches, complete with **bricks, sand** (excluding cost of excavation), supply and fixing. | Metre | 1515 |
| 25-232 | Same as item 25-231, but 4 core, 25 $mm^2$. | Metre | 2130 |
| 25-233 | Same as item 25-231, but 4 core, 35 $mm^2$. | Metre | 2770 |
| 25-234 | Same as item 25-231, but 4 core, 50 $mm^2$. | Metre | 3639 |
| 25-235 | Same as item 25-231, but 4 core, 70 $mm^2$. | Metre | 4978 |
| 25-236 | Same as item 25-231, but 4 core, 95 $mm^2$. | Metre | 6658 |
| 25-237 | Same as item 25-231, but 4 core, 120 $mm^2$. | Metre | 8333 |
| 25-238 | Same as item 25-231, but 4 core, 150 $mm^2$. | Metre | 10167 |
| 25-239 | Same as item 25-231, but 4 core, 185 $mm^2$. | Metre | 12503 |
| 25-240 | Same as item 25-231, but 4 core, 240 $mm^2$. | Metre | 16172 |
| 25-241 | Same as item 25-231, but 4 core, 300 $mm^2$. | Metre | 20220 |
| 25-242 | Cable electric LT PVC insulated, PVC sheathed, **steel wire armoured,** overall PVC 600/1000 V, with stranded Copper conductor, 16 $mm^2$, 4 core, laid in **GI/RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 1240 |
| 25-243 | Same as item 25-242, but 4 core, 25 $mm^2$. | Metre | 1844 |
| 25-244 | Same as item 25-242, but 4 core, 35 $mm^2$. | Metre | 2474 |
| 25-245 | Same as item 25-242, but 4 core, 50 $mm^2$. | Metre | 3342 |
| 25-246 | Same as item 25-242, but 4 core, 70 $mm^2$. | Metre | 4670 |
| 25-247 | Same as item 25-242, but 4 core, 95 $mm^2$. | Metre | 6350 |
| 25-248 | Same as item 25-242, but 4 core, 120 $mm^2$. | Metre | 8014 |
| 25-249 | Same as item 25-242, but 4 core, 150 $mm^2$. | Metre | 9848 |
| 25-250 | Same as item 25-242, but 4 core, 185 $mm^2$. | Metre | 12173 |
| 25-251 | Same as item 25-242, but 4 core, 240 $mm^2$. | Metre | 15841 |
| 25-252 | Same as item 25-242, but 4 core, 300 $mm^2$. | Metre | 19878 |
| 25-253 | Same as item 25-231 to 25-241, but fixing only. | Metre | 404 |
| 25-254 | Same as item 25-242 to 25-252, but fixing only. | Metre | 74 |
| 25-255 | Add to item 25-231 to 25-241 or 25-253, if removal only. | Met.re | 74 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-256 | Add to item 25-242 to 25-252 or 25-254, if removal only. | Metre | 74 |
| 25-257 | Cable electric LT, PVC insulated, PVC sheathed, **un-armoured,** overall PVC 600/1000 V, with stranded copper conductor 16 $mm^2$, 4 core laid in trenches complete with **bricks, sand** (excluding cost of excavation), supply and fixing. | Metre | 1426 |
| 25-258 | Same as item 25-257, but 4 core, 25 $mm^2$. | Meter | 2017 |
| 25-259 | Same as item 25-257, but 4 core, 35 $mm^2$. | Metre | 2615 |
| 25-260 | Same as item 25-257, but 4 core, 50 $mm^2$. | Metre | 3380 |
| 25-261 | Same as item 25-257, but 4 core, 70 $mm^2$. | Metre | 4679 |
| 25-262 | Same as item 25-257, but 4 core, 95 $mm^2$. | Metre | 6308 |
| 25-263 | Same as item 25-257, but 4 core, 120 $mm^2$. | Metre | 7840 |
| 25-264 | Same as item 25-257, but 4 core, 150 $mm^2$. | Metre | 9625 |
| 25-265 | Same as item 25-257, but 4 core, 185 $mm^2$. | Metre | 11883 |
| 25-266 | Same as item 25-257, but 4 core, 240 $mm^2$. | Metre | 15302 |
| 25-267 | Same as item 25-257, but 4 core, 300 $mm^2$. | Metre | 19440 |
| 25-268 | **Cable electric** LT, PVC insulated, PVC sheathed, **un-armoured,** overall PVC 600/1000 V, with stranded Copper conductor, 16 $mm^2$, 4 core, laid in **GI/RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 1096 |
| 25-269 | Same as item 25-268, but 4 core, 25 $mm^2$. | Metre | 1687 |
| 25-270 | Same as item 25-268, but 4 core, 35 $mm^2$. | Metre | 2285 |
| 25-271 | Same as item 25-268, but 4 core, 50 $mm^2$. | Metre | 3050 |
| 25-272 | Same as item 25-268, but 4 core, 70 $mm^2$. | Metre | 4349 |
| 25-273 | Same as item 25-268, but 4 core, 95 $mm^2$. | Metre | 5978 |
| 25-274 | Same as item 25-268, but 4 core, 120 $mm^2$. | Metre | 7510 |
| 25-275 | Same as item 25-268, but 4 core, 150 $mm^2$. | Metre | 9295 |
| 25-276 | Same as item 25-268, but 4 core, 185 $mm^2$. | Metre | 11554 |
| 25-277 | Same as item 25-268, but 4 core, 240 $mm^2$. | Metre | 14972 |
| 25-278 | Same as item 25-268, but 4 core, 300 $mm^2$. | Metre | 19111 |
| 25-279 | Same as item 25-257 to 25-267, but fixing only. | Metre | 404 |
| 25-280 | Same as item 25-268 to 25-278, but fixing only. | Metre | 74 |
| 25-281 | Add to item 25-257 to 25-267 or 25-279, if removal only. | Metre | 83 |
| 25-282 | Add to item 25-268 to 25-278 or 25-280, if removal only. | Metre | 74 |
| 25-283 | **Cable electric** LT, PVC insulated, PVC sheathed, **steel wire armoured** overall PVC 600/1000 V, with stranded **copper conductor,** 25 $mm^2$, 3½ core, laid in trenches, complete with **bricks, sand** (excluding cost of excavation), supply and fixing. | Metre | 1982 |
| 25-284 | Same as item 25-283, but 3½ core, 35 $mm^2$. | Metre | 2479 |
| 25-285 | Same as item 25-283, but 3½ core, 50 $mm^2$. | Metre | 3207 |
| 25-286 | Same as item 25-283, but 3½ core, 70 $mm^2$. | Metre | 4441 |
| 25-287 | Same as item 25-283, but 3½ core, 95 $mm^2$. | Metre | 5914 |
| 25-288 | Same as item 25-283, but 3½ core, 120 $mm^2$. | Metre | 7516 |
| 25-289 | Same as item 25-283, but 3½ core, 150 $mm^2$. | Metre | 8907 |
| 25-290 | Same as item 25-283, but 3½ core, 185 $mm^2$. | Metre | 11067 |
| 25-291 | Same as item 25-283, but 3½ core, 240 $mm^2$. | Metre | 14236 |
| 25-292 | Same as item 25-283, but 3½ core, 300 $mm^2$. | Metre | 17927 |
| 25-293 | **Cable electric** LT, PVC insulated, PVC sheathed, **steel wire armoured** overall PVC 600/1000 V, with stranded Copper conductor, 25 $mm^2$, 3½ core, laid in **GI/RCC pipe/duct** (excluding cost of pipe/ duct), supply and fixing. | Metre | 1696 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-294 | Same as item 25-293, but 3½ core, 35 $mm^2$. | Metre | 2182 |
| 25-295 | Same as item 25-293, but 3½ core, 50 $mm^2$. | Metre | 2910 |
| 25-296 | Same as item 25-293, but 3½ core, 70 $mm^2$. | Metre | 4133 |
| 25-297 | Same as item 25-293, but 3½ core, 95 $mm^2$. | Metre | 5606 |
| 25-298 | Same as item 25-293, but 3½ core, 120 $mm^2$. | Metre | 7197 |
| 25-299 | Same as item 25-293, but 3½ core, 150 $mm^2$. | Metre | 8588 |
| 25-300 | Same as item 25-293, but 3½ core, 185 $mm^2$. | Metre | 10737 |
| 25-301 | Same as item 25-293, but 3½ core, 240 $mm^2$. | Metre | 13906 |
| 25-302 | Same as item 25-293, but 3½ core, 300 $mm^2$. | Metre | 17585 |
| 25-303 | Same as item 25-283 to 25-292, but fixing only. | Metre | 404 |
| 25-304 | Same as item 25-293 to 25-302, but fixing only. | Metre | 74 |
| 25-305 | Add to item 25-283 to 25-292 or 25-303, if removal only. | Metre | 74 |
| 25-306 | Add to item 25-293 to 25-302 or 25-304, if removal only. | Metre | 74 |
| 25-307 | Cable electric LT, PVC insulated, PVC sheathed, **un-armoured,** overall PVC 600/1000 V, with stranded copper conductor 25 $mm^2$, but 3½ core, laid in trenches complete with **bricks, sand** (excluding cost of excavation), supply and fixing. | Metre | 1863 |
| 25-308 | Same as item 25-307, but 3½ core, 35 $mm^2$. | Metre | 2321 |
| 25-309 | Same as item 25-307, but 3½ core, 50 $mm^2$. | Metre | 3041 |
| 25-310 | Same as item 25-307, but 3½ core, 70 $mm^2$. | Metre | 4178 |
| 25-311 | Same as item 25-307, but 3½ core, 95 $mm^2$. | Metre | 5581 |
| 25-312 | Same as item 25-307, but 3½ core, 120 $mm^2$. | Metre | 7054 |
| 25-313 | Same as item 25-307, but 3½ core, 150 $mm^2$. | Metre | 8398 |
| 25-314 | Same as item 25-307, but 3½ core, 185 $mm^2$. | Metre | 10498 |
| 25-315 | Same as item 25-307, but 3½ core, 240 $mm^2$. | Metre | 13575 |
| 25-316 | Same as item 25-307, but 3½ core, 300 $mm^2$. | Metre | 17132 |
| 25-317 | Cable electric LT, 600/1000 V, PVC insulated, **un-armoured** overall stranded copper conductor 25 $mm^2$, 3½ core, laid in **GI/RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 1533 |
| 25-318 | Same as item 25-317, but 3½ core, 35 $mm^2$. | Metre | 1991 |
| 25-319 | Same as item 25-317, but 3½ core, 50 $mm^2$. | Metre | 2711 |
| 25-320 | Same as item 25-317, but 3½ core, 70 $mm^2$. | Metre | 3848 |
| 25-321 | Same as item 25-317, but 3½ core, 95 $mm^2$. | Metre | 5250 |
| 25-322 | Same as item 25-317, but 3½ core, 120 $mm^2$. | Metre | 6724 |
| 25-323 | Same as item 25-317, but 3½ core, 150 $mm^2$. | Metre | 8068 |
| 25-324 | Same as item 25-317, but 3½ core, 185 $mm^2$. | Metre | 10168 |
| 25-325 | Same as item 25-317, but 3½ core, 240 $mm^2$. | Metre | 13245 |
| 25-326 | Same as item 25-317, but 3½ core, 300 $mm^2$. | Metre | 16802 |
| 25-327 | Same as item 25-307 to 25-316, but fixing only. | Metre | 404 |
| 25-328 | Same as item 25-317 to 25-326, but fixing only. | Metre | 74 |
| 25-329 | Add to item 25-307 to 25-316 or 25-327, if removal only. | Metre | 83 |
| 25-330 | Add to item 25-317 to 25-326 or 25-328, if removal only. | Metre | 74 |
| | **Cable Electric LT single core copper conductor** | | |
| 25-331 | Cable electric LT, 600/1000 V, stranded copper conductor insulated extruded PVC bedded, **steel wire armoured** and PVC sheathed overall Single core, 16 $mm^2$ laid in trenches complete with **bricks, sand** (excluding cost of excavation) supply and fixing. | Metre | 633 |
| 25-332 | Same as item 25-331, but 25 $mm^2$. | Metre | 774 |
| 25-333 | Same as item 25-331, but 35 $mm^2$. | Metre | 923 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-334 | Same as item 25-331, but 50 $mm^2$. | Metre | 1100 |
| 25-335 | Same as item 25-331, but 70 $mm^2$. | Metre | 1425 |
| 25-336 | Same as item 25-331, but 95 $mm^2$. | Metre | 1813 |
| 25-337 | Same as item 25-331, but 120 $mm^2$. | Metre | 2190 |
| 25-338 | Same as item 25-331, but 150 $mm^2$. | Metre | 2622 |
| 25-339 | Same as item 25-331, but 185 $mm^2$. | Metre | 3170 |
| 25-340 | Same as item 25-331, but 240 $mm^2$. | Metre | 4038 |
| 25-341 | Same as item 25-331, but 300 $mm^2$. | Metre | 5399 |
| 25-342 | Cable electric LT, 600/1000 V, stranded copper conductor insulated extruded PVC bedded, **steel wire armoured** and PVC sheathed overall single core, 16 $mm^2$ Laid in **GI/ RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 322 |
| 25-343 | Same as item 25-342, but 25 $mm^2$. | Metre | 462 |
| 25-344 | Same as item 25-342, but 35 $mm^2$. | Metre | 611 |
| 25-345 | Same as item 25-342, but 50 $mm^2$. | Metre | 800 |
| 25-346 | Same as item 25-342, but 70 $mm^2$. | Metre | 1114 |
| 25-347 | Same as item 25-342, but 95 $mm^2$. | Metre | 1509 |
| 25-348 | Same as item 25-342, but 1.20 $mm^2$. | Metre | 1878 |
| 25-349 | Same as item 25-342, but 150 $mm^2$. | Metre | 2310 |
| 25-350 | Same as item 25-342, but 185 $mm^2$. | Metre | 2859 |
| 25-351 | Same as item 25-342, but 240 $mm^2$. | Metre | 3726 |
| 25-352 | Same as item 25-342, but 300 $mm^2$. | Metre | 4684 |
| 25-353 | Same as item 25-331 to 25-341, but fixing only. | Metre | 384 |
| 25-354 | Same as item 25-342 to 25-352, but fixing only. | Metre | 74 |
| 25-355 | Add to item 25-331 to 25-341 or 25-353, if removal only. | Metre | 67 |
| 25-356 | Add to item 25-342 to 25-352 or 25-354, if removal only. | Metre | 74 |
| 25-357 | Cable electric LT, 600/1000 V, stranded copper conductor insulated, extruded, PVC **unMarmoured** and PVC sheathed overall, single core, 16 $mm^2$ laid in trenches complete with **bricks, sand** (excluding cost of excavation) supply and fixing. | Metre | 597 |
| 25-358 | Same as item 25-357, but 25 $mm^2$. | Metre | 761 |
| 25-359 | Same as item 25-357, but 35 $mm^2$. | Metre | 877 |
| 25-360 | Same as item 25-357, but 50 $mm^2$. | Metre | 1074 |
| 25-361 | Same as item 25-357, but 70 $mm^2$. | Metre | 1385 |
| 25-362 | Same as item 25-357, but 95 $mm^2$. | Metre | 1770 |
| 25-363 | Same as item 25-357, but 120 $mm^2$. | Metre | 2135 |
| 25-364 | Same as item 25-357, but 150 $mm^2$. | Metre | 2570 |
| 25-365 | Same as item 25-357, but 185 $mm^2$. | Metre | 3123 |
| 25-366 | Same as item 25-357, but 240 $mm^2$. | Metre | 3983 |
| 25-367 | Same as item 25-357, but 300 $mm^2$. | Metre | 4905 |
| 25-368 | Cable electric LT, 600/1000 volts stranded copper conductor insulated, extruded, PVC **UnMarmoured** and PVC sheathed overall, single core, 16 $mm^2$ laid in **GI/ RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 311 |
| 25-369 | Same as item 25-368, but 25 $mm^2$. | Metre | 449 |
| 25-370 | Same as item 25-368, but 35 $mm^2$. | Metre | 580 |
| 25-371 | Same as item 25-368, but 50 $mm^2$. | Metre | 778 |
| 25-372 | Same as item 25-368, but 70 $mm^2$. | Metre. | 1089 |
| 25-373 | Same as item 25-368, but 95 $mm^2$. | Metre | 1478 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-374 | Same as item 25-368, but 120 $mm^2$. | Metre | 1828 |
| 25-375 | Same as item 25-368, but 150 $mm^2$. | Metre | 2270 |
| 25-376 | Same as item 25-368, but 185 $mm^2$. | Metre | 2812 |
| 25-377 | Same as item 25-368, but 240 $mm^2$. | Metre | 3671 |
| 25-378 | Same as item 25-368, but 300 $mm^2$. | Metre | 4619 |
| 25-379 | Same as item 25-357 to 25-367 but fixing only. | Metre | 364 |
| 25-380 | Same as item 25-368 to 25-378, but fixing only. | Metre | 74 |
| 25-381 | Add to item 25-357 to 25-367 or 25-379, if removal only. | Metre | 49 |
| 25-382 | Add to item 25-368 to 25-378 or 25-380, if removal only. | Metre | 74 |
| 25-383 | **Cable electric** LT, PVC insulated, PVC sheathed, **steel wire armoured,** overall PVC, 600/1000 V with stranded **aluminium conductor,** 25 $mm^2$, 4 core, laid in trenches, complete with **bricks, sand** (excluding cost of excavation), supply and fixing. | Metre | 964 |
| 25-384 | Same as item 25-383, but 35 $mm^2$. | Metre | 1094 |
| 25-385 | Same as item 25-383, but 50 $mm^2$. | Metre | 1370 |
| 25-386 | Same as item 25-383, but 70 $mm^2$. | Metre | 1625 |
| 25-387 | Same as item 25-383, but 95 $mm^2$. | Metre | 1983 |
| 25-388 | Same as item 25-383, but 120 $mm^2$. | Metre | 2371 |
| 25-389 | Same as item 25-383, but 150 $mm^2$. | Metre | 2756 |
| 25-390 | Same as item 25-383, but 185 $mm^2$. | Metre | 3219 |
| 25-391 | Same as item 25-383, but 240 $mm^2$. | Metre | 3812 |
| 25-392 | Same as item 25-383, but 300 $mm^2$. | Metre | 4454 |
| 25-393 | **Cable electric LT,** PVC insulated, PVC sheathed, **steel wire armoured,** overall, PVC 600/1000 V, with stranded aluminium conductor, 25 $mm^2$, 4 core laid in **GI** / **RCC pipe/ duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 634 |
| 25-394 | Same as item 25-393, but 35 $mm^2$. | Metre | 764 |
| 25-395 | Same as item 25-393, but 50 $mm^2$. | Metre | 1040 |
| 25-396 | Same as item 25-393, but 70 $mm^2$. | Metre | 1295 |
| 25-397 | Same as item 25-393, but 95 $mm^2$. | Metre | 1653 |
| 25-398 | Same as item 25-393, but 120 $mm^2$. | Metre | 2040 |
| 25-399 | Same as item 25-393, but 150 $mm^2$. | Metre | 2426 |
| 25-400 | Same as item 25-393, but 185 $mm^2$. | Metre | 2889 |
| 25-401 | Same as item 25-393, but 240 $mm^2$. | Metre | 3482 |
| 25-402 | Same as item 25-393, but 300 $mm^2$. | Metre | 4124 |
| 25-403 | Same as item 25-383 to 25-392, but fixing only. | Metre | 404 |
| 25-404 | Same as item 25-393 to 25-402, but fixing only. | Metre | 74 |
| 25-405 | Add to item 25-383 to 25-392 or 25-403, if removal only. | Metre | 74 |
| 25-406 | Add to item 25-393 to 25-402 or 25-404, if removal only. | Metre | 74 |
| 25-407 | **Cable electric** LT, PVC insulated, PVC sheathed, **un-armoured,** overall, PVC 600/1000 V, with stranded **aluminium conductor,** 25 $mm^2$, 4 core laid in trenches complete with **bricks, sand** (excluding cost of excavation), supply and fixing. | Metre | 707 |
| 25-408 | Same as item 25-407, but 35 $mm^2$. | Metre | 792 |
| 25-409 | Same as item 25-407, but 50 $mm^2$. | Metre | 924 |
| 25-410 | Same as item 25-407, but 70 $mm^2$. | Metre | 1107 |
| 25-411 | Same as item 25-407, but 95 $mm^2$. | Metre | 1362 |
| 25-412 | Same as item 25-407, but 120 $mm^2$. | Metre | 1575 |
| 25-413 | Same as item 25-407, but 150 $mm^2$. | Metre | 1841 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-414 | Same as item 25-407, but 185 $mm^2$. | Metre | 2166 |
| 25-415 | Same as item 25-407, but 240 $mm^2$. | Metre | 2689 |
| 25-416 | Same as item 25-407, but 300 $mm^2$. | Metre | 3197 |
| 25-417 | **Cable electric** LT, PVC insulated, PVC sheathed, **un-armoured,** overall PVC, 600/1000 V, with stranded aluminium conductor, 25 $mm^2$, 4 core laid in **GI/ duct pipe/duct** (excluding cost of pipe/ duct), supply and fixing. | Metre | 377 |
| 25-418 | Same as item 25-417, but 35 $mm^2$. | Metre | 462 |
| 25-419 | Same as item 25-417, but 50 $mm^2$. | Metre | 594 |
| 25-420 | Same as item 25-417, but 70 $mm^2$. | Metre | 777 |
| 25-421 | Same as item 25-417, but 95 $mm^2$. | Metre | 1031 |
| 25-422 | Same as item 25-417, but 120 $mm^2$. | Metre | 1245 |
| 25-423 | Same as item 25-417, but 150 $mm^2$. | Metre | 1511 |
| 25-424 | Same as item 25-417, but 185 $mm^2$. | Metre | 1836 |
| 25-425 | Same as item 25-417, but 240 $mm^2$. | Metre | **2358** |
| 25-426 | Same as item 25-417, but 300 $mm^2$. | Metre | 2867 |
| 25-427 | Same as item 25-407 to 25-416, but fixing only. | Metre | 404 |
| **25-428** | Same as item 25-417 to 25-426, but fixing only. | Metre | **74** |
| **25-429** | Add to item 25-407 to 25-416 or 25-427, if removal only. | Metre | 74 |
| 25-430 | Add to item 25-417 to 25-426 or 25-428, if removal only. | Metre | **74** |
| | **Cable electric LT single core** | | |
| | Aluminium conductor | | |
| 25-431 | Cable electric LT, 600/1000 V, stranded aluminium conductor, insulated extruded, PVC bedded, **steel wire armoured** and PVC sheathed overall single core, 16 $mm^2$ laid in trenches complete with **bricks, sand** (excluding cost of excavation) supply and fixing. | Metre | 456 |
| 25-432 | Same as item 25-431, but 25 $mm^2$. | Metre | 495 |
| 25-433 | Same as item 25-431, but 35 $mm^2$. | Metre | 524 |
| 25-434 | Same as item 25-431, but 50 $mm^2$. | Metre | 576 |
| 25-435 | Same as item 25-431, but 70 $mm^2$. | Metre | 641 |
| 25-436 | Same as item 25-431, but 95 $mm^2$. | Metre | 715 |
| 25-437 | Same as item 25-431, but 120 $mm^2$. | Metre | 801 |
| 25-438 | Same as item 25-431, but 150 $mm^2$. | Metre | 882 |
| 25-439 | Same as item 25-431, but 185 $mm^2$. | Metre | 1006 |
| 25-440 | Same as item 25-431, but 240 $mm^2$. | Metre | 1209 |
| 25-441 | Same as item 25-431, but 300 $mm^2$. | Metre | 1365 |
| 25-442 | Cable electric LT, 600/1000 V, stranded aluminium conductor insulated extruded, PVC bedded, **steel wire armou ed** and PVC sheathed overall Single core, 16 $mm^2$ laid in **GI/ RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 144 |
| 25-443 | Same as item 25-442, but 25 $mm^2$. | Metre | 184 |
| 25-444 | Same as item 25-442, but 35 $mm^2$. | Metre | 213 |
| 25-445 | Same as item 25-442, but 50 $mm^2$. | Metre | 264 |
| 25-446 | Same as item 25-442, but 70 $mm^2$. | Metre | 329 |
| 25-447 | Same as item 25-442, but 95 $mm^2$. | Metre | 418 |
| 25-448 | Same as item 25-442, but 120 $mm^2$. | Metre | 504 |
| 25-449 | Same as item 25-442, but 150 $mm^2$. | Metre | 586 |
| 25-450 | Same as item 25-442, but 185 $mm^2$. | Metre | 695 |
| 25-451 | Same as item 25-442, but 240 $mm^2$. | Metre | 897 |
| 25-452 | Same as item 25-442, but 300 $mm^2$. | Metre | 1011 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-453 | Same as item 25-431 to 25-441 but fixing only. | Metre | 404 |
| 25-454 | Same as item 25-442 to 25-452 but fixing only. | Metre | 74 |
| 25-455 | Add to item 25-431 to 25-441 or 25-453 if removal only. | Metre | 56 |
| 25-456 | Add to item 25-442 to 25-452 or 25-454 if removal only. | Metre | 74 |
| 25-457 | Cable electric LT, 600/1000 V stranded aluminium conductor, insulated extruded PVC **Un-armoured** and PVC sheathed overall single core, 16 $mm^2$ laid in trenches complete with **bricks, sand** (excluding cost of excavation) supply and fixing. | Metre | 429 |
| 25-458 | Same as item 25-457, but 25 $mm^2$. | Metre | 450 |
| 25-459 | Same as item 25-457, but 35 $mm^2$. | Metre | 474 |
| 25-460 | Same as item 25-457, but 50 $mm^2$. | Metre | 497 |
| 25-461 | Same as item 25-457, but 70 $mm^2$. | Metre | 561 |
| 25-462 | Same as item 25-457, but 95 $mm^2$. | Metre | 624 |
| 25-463 | Same as item 25-457, but 120 $mm^2$. | Metre | 660 |
| 25-464 | Same as item 25-457, but 150 $mm^2$. | Metre | 740 |
| 25-465 | Same as item 25-457, but 185 $mm^2$. | Metre | 812 |
| 25-466 | Same as item 25-457, but 240 $mm^2$. | Metre | 941 |
| 25-467 | Same as item 25-457, but 300 $mm^2$. | Metre | 1078 |
| 25-468 | Cable electric LT, 600/1000 V, stranded aluminium conductor insulated, extruded, PVC **Un-armoured** and PVC sheathed overall Single core, 16 $mm^2$ Laid in **GI/ RCC pipe/duct** (excluding cost of pipe/duct), supply and fixing. | Metre | 118 |
| 25-469 | Same as item 25-468, but 25 $mm^2$. | Metre | 143 |
| 25-470 | Same as item 25-468, but 35 $mm^2$. | Metre | 164 |
| 25-471 | Same as item 25-468, but 50 $mm^2$. | Metre | 201 |
| 25-472 | Same as item 25-468, but 70 $mm^2$. | Metre | 250 |
| 25-473 | Same as item 25-468, but 95 $mm^2$. | Metre | 312 |
| 25-474 | Same as item 25-468, but 120 $mm^2$. | Metre | 364 |
| 25-475 | Same as item 25-468, but 150 $mm^2$. | Metre | 429 |
| 25-476 | Same as item 25-468, but 185 $mm^2$. | Metre | 515 |
| 25-477 | Same as item 25-468, but 240 $mm^2$. | Metre | 644 |
| 25-478 | Same as item 25-468, but 300 $mm^2$. | Metre | 781 |
| 25-479 | Same as item 25-457 to 25-467 but fixing only. | Metre | 41 |
| 25-480 | Same as item 25-468 to 25-478 but fixing only. | Metre | 90 |
| 25-481 | Add to item 25-457 to 25-467 or 25-479 if removal only. | Metre | 55 |
| 25-482 | Add to item 25-468 to 25-478 or 25-480 if removal only. | Metre | 90 |
| | **PVC, Straight joint** | | |
| 25-483 | **PVC, Straight joint** LT, consisting of mould resin, padding tape, funnels and ferrules etc as specified for PVC un-armoured LT cable 4 core, 16 $mm^2$, supply and fixing. | Each | 4195 |
| 25-484 | Same as item 25-483, but 25 $mm^2$ to 35 $mm^2$. | Each | 5718 |
| 25-485 | Same as item 25-483, but 50 $mm^2$ to 70 $mm^2$. | Each | 7518 |
| 25-486 | Same as item 25-483, but 95 $mm^2$ to 150 $mm^2$. | Each | 10077 |
| 25-487 | Same as item 25-483, but 185 $mm^2$ to 300 $mm^2$. | Each | 10557 |
| 25-488 | Same as item 25-483 to 25-485, but fixing only. | Each | 1518 |
| 25-489 | Same as item 25-486 to 25-487, but fixing only. | Each | 2277 |
| 25-490 | Add to item 25-483 to 25-485 or 25-488, if _removal only. | Each | 276 |
| 25-491 | Add to item 25-486 to 25-487 or 25'-489, if removal only. | Each | 414 |
| 25-492 | **PVC Straight Joint** LT, complete with, tapes, ferrules and heat tubes etc, | Each | 4732 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | as specified for PVC armoured, LT Cable 4 core 16 $mm^2$, supply and fixing. | | |
| 25-493 | Same as item 25-492, but 25 $mm^2$ to 35 $mm^2$. | Each | 8526 |
| 25-494 | Same as item 25-492, but 50 $mm^2$ to 70 $mm^2$. | Each | 10310 |
| 25-495 | Same as item 25-492, but 95 $mm^2$ to 150 $mm^2$. | Each | 13186 |
| 25-496 | Same as item 25-492, but 185 $mm^2$ to 300 $mm^2$. | Each | 17826 |
| 25-497 | Same as item 25-492 to 25-493, but fixing only. | Each | 1518 |
| 25-498 | Same as item 25-494, but fixing only. | Each | 2277 |
| 25-499 | Same as item 25-495 to 25-496, but fixing only. | Each | 3036 |
| 25-500 | Add to item 25-492 to 25-499, if removal only. | Each | 414 |
| 25-501 | **PVC, T-Service Joint** LT, comprising mould resin, padding tape, funnels and ferrules etc, as specified for LT cable, 4 core, 16 $mm^2$, supply and fixing. | Each | 6899 |
| 25-502 | Same as item 25-501, but 25 $mm^2$ to 50 $mm^2$ x 16 $mm^2$ to 25 $mm^2$. | Each | 8764 |
| 25-503 | Same as item 25-501, but 70 $mm^2$ to 95 $mm^2$ x 35 to 50 $mm^2$. | Each | 11877 |
| 25-504 | Same as item 25-501, but 120 $mm^2$ to 185 $mm^2$ x 70 $mm^2$ to 95 $mm^2$. | Each | 22913 |
| 25-505 | Same as item 25-501, but fixing only. | Each | 1822 |
| 25-506 | Same as item 25-502, but fixing only. | Each | 2277 |
| 25-507 | Same as item 25-503, but fixing only. | Each | 3036 |
| 25-508 | Same as item 25-504, but fixing only. | Each | 3795 |
| 25-509 | Add to item 25-501 to 25-508, if removal only. | Each | 276 |
| 25-510 | **PVC Heat Shrink (HS) Termination Kit,** LT indoor/ outdoor, consisting of heat shrink, boot lugs, clips and earth wire etc, suitable for LT cables, 4 core, 16 $mm^2$, PVC **un-armoured,** supply and fixing. | Each | 6022 |
| 25-511 | Same as item 25-510, but 25 $mm^2$ to 35 $mm^2$. | Each | 6325 |
| 25-512 | Same as item 25-510, but 50 $mm^2$ to 70 $mm^2$. | Each | 8277 |
| 25-513 | Same as item 25-510, but 95 $mm^2$ to 150 $mm^2$. | Each | 10229 |
| 25-514 | Same as item 25-510, but 185 $mm^2$ to 300 $mm^2$. | Each | 12075 |
| 25-515 | Same as item 25-510, but fixing only. | Each | 1822 |
| 25-516 | Same as item 25-511, but fixing only. | Each | 2125 |
| 25-517 | Same as item 25-512, but fixing only. | Each | 2277 |
| 25-518 | Same as item 25-513, but fixing only. | Each | 2429 |
| 25-519 | Same as item 25-514, but fixing only. | Each | 3795 |
| 25-520 | Add to item 25-510 to 25-519, if removal only. | Each | 414 |
| 25-521 | **PVC Heat Shrink (HS) Termination kit** LT, 4 core, indoor/outdoor, consisting of heat shrink boot, lugs, clips and earth wire etc suitable for LT Cable, **armoured,** 16 $mm^2$, supply and fixing. | Each | 6562 |
| 25-522 | Same as item 25-521, but 25 $mm^2$ to 35 $mm^2$. | Each | 7885 |
| 25-523 | Same as item 25-521, but 50 $mm^2$ to 70 $mm^2$. | Each | 10077 |
| 25-524 | Same as item 25-521, but 95 $mm^2$ to 150 $mm^2$. | Each | 11249 |
| 25-525 | Same as item 25-521, but 185 $mm^2$ to 300 $mm^2$. | Each | 13995 |
| 25-526 | Same as item 25-521, but fixing only. | Each | 1822 |
| 25-527 | Same as item 25-522, but fixing only. | Each | 2125 |
| 25-528 | Same as item 25-523, but fixing only. | Each | 2277 |
| 25-529 | Same as item 25-524, but fixing only. | Each | 2429 |
| 25-530 | Same as item 25-525, but fixing only. | Each | 3795 |
| 25-531 | Add to item 25-521 to 25-530, if removal only. | Each | 414 |
| 25-532 | **PVC Termination kit,** HT 11 KV, indoor heat shrink, complete wit tubes, copper Lugs, HT and PIB tapes and earth wire, suitable for HT cables, | Each | 13474 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | XLPE, 3 core, 16 mm$^2$ to 35 mm$^2$, supply and fixing. | | |
| 25-533 | Same as item 25-532, but for HT cable XLPE, 3 core, 50 to 95 mm$^2$. | Each | 15492 |
| 25-534 | Same as item 25-532, but for HT cable XLPE, 3 core, 120 to185 mm$^2$. | Each | 20664 |
| 25-535 | Same as item 25-532, but for HT cable XLPE, 3 core, 240 to 300 mm$^2$. | Each | 22910 |
| 25-536 | **PVC Termination kit,** HT, 11 KV outdoor, heat shrink, complete with tubes, copper lugs, HT and PIB tapes and earth wire suitable for HT cable, XLPE, 3 core, 16 mm$^2$ to 35 mm$^2$, supply and fixing. | Each | 13474 |
| 25-537 | Same as item 25-536 but 50 mm$^2$ to 95 mm$^2$. | Each | 15492 |
| 25-538 | Same as item 25-536 but 120 mm$^2$ to 185 mm$^2$. | Each | 20664 |
| 25-539 | Same as item 25-536 but 240 mm$^2$ to 300 mm$^2$. | Each | 22910 |
| 25-540 | Same as item 25-532 or 25-536, but fixing only. | Each | 3274 |
| 25-541 | Same as item 25-533 or 25-237, but fixing only. | Each | 4092 |
| 25-542 | Same as item 25-534 or 25-538, but fixing only. | Each | 4464 |
| 25-543 | Same as item 25-535 or 25-539, but fixing only. | Each | 4910 |
| 25-544 | Add to item 25-532 to 25-543, if removal only. | Each | 414 |
| 25-545 | PVC, Straight joint, HT, 11 KV for XLPE cable, consisting of mould resin, HT tape, semi conducting tape, ferrules and earth wire etc suitable for HT cables, 3 core, 16 mm$^2$ to 35 mm$^2$, supply and fixing. | Each | 22474 |
| 25-546 | Same as item 25-545, but for HT cable XLPE, 3 core, 50 mm$^2$ to 95 mm$^2$. | Each | 28092 |
| 25-547 | Same as item 25-545, but for HT cable XLPE, 120 mm$^2$ to 185 mm$^2$. | Each | 34310 |
| 25-548 | Same as item 25-545, but for HT cable XLPE, 240 mm$^2$ to 300 mm$^2$. | Each | 38595 |
| 25-549 | Same as item 25-545, but fixing only. | Each | 3274 |
| 25-550 | Same as item 25-546, but fixing only. | Each | 4092 |
| 25-551 | Same as item 25-547, but fixing only. | Each | 4910 |
| 25-552 | Same as item 25-548, but fixing only. | Each | 5115 |
| 25-553 | Add to item 25-545 to 25-552, if removal only. | Each | 558 |
| | **PVC, Straight joint Single core** | | |
| 25-554 | **PVC, Straight joint** LT, consisting of mould resin, padding tape, funnels and ferrules etc as specified for PVC unarmoured LT cable, Single core, 16 mm$^2$, supply and fixing. | Each | 1094 |
| 25-555 | Same as item 25-554, but 25 mm$^2$ to 35 mm$^2$. | Each | 1859 |
| 25-556 | Same as item 25-554, but 50 mm$^2$ to 70 mm$^2$. | Each | 2465 |
| 25-557 | Same as item 25-554, but 95 mm$^2$ to 150 mm$^2$. | Each | 3180 |
| 25-558 | Same as item 25-554, but 185 mm$^2$ to 300 mm$^2$. | Each | 4440 |
| 25-559 | Same as item 25-554 to 25-556, but fixing only. | Each | 380 |
| 25-560 | Same as item 25-557 to 25-558, but fixing only. | Each | 569 |
| 25-561 | Add to item 25-554 to 25-556 or 25-559, if removal only. | Each | 138 |
| 25-562 | Add to item 25-557 to 25-558 or 25-560, if removal only. | Each | 207 |
| 25-563 | **PVC Straight Joint** LT, complete with tapes, ferrules and heat tubes etc, as specified for PVC armoured LT cable, Single core, 16 mm$^2$, supply and fixing. | Each | 1411 |
| 25-564 | Same as item 25-563, but 25 mm$^2$ to 35 mm$^2$. | Each | 2241 |
| 25-565 | Same as item 25-563, but 50 mm$^2$ to 70 mm$^2$. | Each | 3135 |
| 25-566 | Same as item 25-563, but 95 mm$^2$ to 150 mm$^2$. | Each | 4023 |
| 25-567 | Same as item 25-563, but 185 mm$^2$ to 300 mm$^2$. | Each | 6487 |
| 25-568 | Same as item 25-563 to 25-564, but fixing only. | Each | 380 |
| 25-569 | Same as item 25-565, but fixing only. | Each | 759 |
| 25-570 | Same as item 25-566 to 25-567, but fixing only. | Each | 759 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-571 | Add to item 25-563 to 25-570, if removal only. | Each | 518 |
| 25-572 | **PVC, T-Service Joint,** LT comprising mould resin, padding tape, funnels and ferrules etc, as specified for LT cable, Single core, 16 $mm^2$, supply and fixing. | Each | 2137 |
| 25-573 | Same as item 25-572, but 25 $mm^2$ to 50 $mm^2$ x 16 $mm^2$ to 25 $mm^2$. | Each | 2236 |
| 25-574 | Same as item 25-572, but 70 $mm^2$ to 95 $mm^2$ x 35 to 50 $mm^2$. | Each | 3128 |
| 25-575 | Same as item 25-572, but 120 $mm^2$ to 185 $mm^2$ x 70 $mm^2$ to 95 $mm^2$. | Each | 5856 |
| 25-576 | Same as item 25-572, but fixing only. | Each | 455 |
| 25-577 | Same as item 25-573, but fixing only. | Each | 569 |
| 25-578 | Same as item 25-574, but fixing only. | Each | 759 |
| 25-579 | Same as item 25-575, but fixing only. | Each | 949 |
| 25-580 | Add to item 25-572 to 25-579, if removal only. | Each | 138 |
| 25-581 | **PVC Heat Shrink (HS) Termination Kit,** LT indoor/outdoor, consisting of heat shrink, boot lugs, clips and earth wire etc, suitable for LT cables, Single core, 16 $mm^2$ PVC **un-armoured,** supply and fixing. | Each | 1323 |
| 25-582 | Same as item 25-581, but 25 $mm^2$ to 35 $mm^2$. | Each | 2215 |
| 25-583 | Same as item 25-581, but 50 $mm^2$ to 70 $mm^2$. | Each | 2762 |
| 25-584 | Same as item 25-581, but 95 $mm^2$ to 150 $mm^2$. | Each | 4340 |
| 25-585 | Same as item 25-581, but 185 $mm^2$ to 300 $mm^2$. | Each | 6515 |
| 25-586 | Same as item 25-581, but fixing only. | Each | 455 |
| 25-587 | Same as item 25-582, but fixing only. | Each | 531 |
| 25-588 | Same as item 25-583, but fixing only. | Each | 569 |
| 25-589 | Same as item 25-584, but fixing only. | Each | 607 |
| 25-590 | Same as item 25-585, but fixing only. | Each | 949 |
| 25-591 | Add to item 25-581 to 25-590, if removal only. | Each | 207 |
| 25-592 | **PVC Heat Shrink (HS) Termination kit** LT, indoor/outdoor, consisting of heat shrink, boot, lugs, clips and earth wire etc suitable for LT cable, **armoured,** 16 $mm^2$, Single core supply and fixing. | Each | 1530 |
| 25-593 | Same as item 25-592, but 25 $mm^2$ to 35 $mm^2$. | Each | 2623 |
| 25-594 | Same as item 25-592, but 50 $mm^2$ to 70 $mm^2$. | Each | 3375 |
| 25-595 | Same as item 25-592, but 95 $mm^2$ to 150 $mm^2$. | Each | 3821 |
| 25-596 | Same as item 25-592, but 185 $mm^2$ to 300 $mm^2$. | Each | 5631 |
| 25-597 | Same as item 25-592, but fixing only. | Each | 449 |
| 25-598 | Same as item 25-593, but fixing only. | Each | 531 |
| 25-599 | Same as item 25-594, but fixing only. | Each | 569 |
| 25-600 | Same as item 25-595, but fixing only. | Each | 607 |
| 25-601 | Same as item 25-596, but fixing only. | Each | 949 |
| 25-602 | Add to item 25-592 to 25-601, if removal only. | Each | 207 |
| 25-603 | **PVC Termination kit,** HT, 11 KV, indoor heat shrink, complete with tubes, copper Lugs, HT and PIB tapes and earth wire, suitable for HT cables, XLPE, Single core, 16 $mm^2$ to 35 $mm^2$, supply and fixing. | Each | 7557 |
| 25-604 | Same as item 25-603, but 50 to 95 $mm^2$. | Each | 8840 |
| 25-605 | Same as item 25-603, but 120 to185 $mm^2$. | Each | 9680 |
| 25-606 | Same as item 25-603, 3 core, 240 to 300 $mm^2$. | Each | 11111 |
| 25-607 | **PVC Termination kit,** HT, 11 KV outdoor, heat shrink, complete with tubes, copper lugs, HT and PIB tapes and earth wire suitable for HT cable, XLPE, Single core, 16 $mm^2$ to 35 $mm^2$, supply and fixing. | Each | 8125 |
| 25-608 | Same as item 25-607, but 50 $mm^2$ to 95 $mm^2$. | Each | 11773 |
| 25-609 | Same as item 25-607, but 120 $mm^2$ to 185 $mm^2$. | Each | 13652 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-610 | Same as item 25-607, but 240 $mm^2$ to 300 $mm^2$. | Each | 14792 |
| 25-611 | Same as item 25-603, or 25-607 but fixing only. | Each | 1362 |
| 25-612 | Same as item 25-604, or 25-608 but fixing only. | Each | 1362 |
| 25-613 | Same as item 25-605, or 25-609 but fixing only. | Each | 1637 |
| 25-614 | Same as item 25-606, or 25-610 but fixing only. | Each | 1702 |
| 25-615 | Add to item 25-603 to 25-614, if removal only. | Each | 279 |
| 25-616 | **PVC Straight joint,** HT, 11 KV for XLPE cable, consisting of mould resin, HT tape, semi conducting tape, ferrules and earth wire etc suitable for HT cables, single core, 16 $mm^2$ to 35 $mm^2$, supply and fixing. | Each | 11392 |
| 25-617 | Same as item 25-616, but for HT cable XLPE, 50 $mm^2$ to 95 $mm^2$. | Each | 12268 |
| 25-618 | Same as item 25-616, but for HT cable XLPE, 120 $mm^2$ to 185 $mm^2$. | Each | 15295 |
| 25-619 | Same as item 25-616, but for HT cable XLPE, 240 $mm^2$ to 300 $mm^2$. | Each | 17616 |
| 25-620 | Same as item 25-616, but fixing only. | Each | 1088 |
| 25-621 | Same as item 25-617, but fixing only. | Each | 1362 |
| 25-622 | Same as item 25-618, but fixing only. | Each | 1637 |
| 25-623 | Same as item 25-619, but fixing only. | Each | 1702 |
| 25-624 | Add to item 25-616 to 25-623, if removal only. | Each | 279 |
| 25-625 | **Danger sign,** for HT and LT, not less than 250 mm x 125 mm size, enamelled as required, supply and fixing. | Each | 736 |
| 25-626 | Same as item 25-625, but fixing only. | Each | 256 |
| 25-627 | Add to item 25-625 or 25-626, if removal only. | Each | 179 |
| 25-628 | **Non Climbable Device,** as specified, (Figure 25-13), supply and fixing. | Each | 1525 |
| 25-629 | Same as item 25-628, but fixing only. | Each | 409 |
| 25-630 | Add to item 25-628 or 25-629, if removal only. | Each | 304 |
| 25-631 | **Phase Indicating sign,** red, blue or yellow as required, supply and fixing. | Each | 529 |
| 25-632 | Same as item 25-631, but fixing only. | Each | 49 |
| 25-633 | Add to item 25-631 or 25-632, if removal only. | Each | 49 |
| 25-634 | **GI clamp for shackle,** insulator or stay wire etc, of approved type, supply and fixing. | Each | 308 |
| 25-635 | Same as item 25-634, but fixing only. | Each | 123 |
| 25-636 | Add to item 25-634 or 25-635, if removal only. | Each | 91 |
| 25-637 | **Lightning Arrester** set of three pieces, complete, with all accessories, for 11 KV line, supply and fixing. | Each | 17286 |
| 25-638 | Same as item 25-637, but fixing only. | Each | 2046 |
| 25-639 | Add to item 25-637 or 25-638, if removal only. | Each | 1432 |
| 25-640 | **Fuse D-link/cut** off fuses assembly, set of three, complete with fuse, angle iron, nut and bolt, etc for 11 KV (assembly unit), supply and fixing. | Each | 19838 |
| 25-641 | Same as item 25-640, but fixing only. | Each | 4092 |
| 25-642 | Add to item 25-640 or 25-641, if removal only. | Each | 2864 |
| 25-643 | **Service Connection,** complete with PVC insulated and PVC sheathed cable, 250 V, twin core, run on GI wire No 8 SWG with brass/iron tinned clips of appropriate size at 20 cm i nterval, size 2.5 $mm^2$, supply and fixing. | Metre | 239 |
| 25-644 | Same as item 25-643, but size, 4 $mm^2$. | Metre | 323 |
| 25-645 | Same as item 25-643 or 25-644, but fixing only. | Metre | 61 |
| 25-646 | Add to item 25-643 to 25-645, if removal only. | Metre | 43 |
| 25-647 | **Service Connection,** complete with PVC insulated and PVC sheathed, 4 cores copper conductor, cable 2.5 $mm^2$, run on No 8 SWG GI wire with brass/iron tinned clips of appropriate size, at 10 cm interval, supply and fixing. | Metre | 399 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-648 | Same as item 25-647, but 4 $mm^2$, 4 core cable. | Metre | 545 |
| 25-649 | Same as item 25-647 or 25-648, but fixing only. | Metre | 82 |
| 25-650 | Add to item 25-647 to 25-649, if removal only. | Metre | 57 |
| 25-651 | **Service Bracket,** comprising 50 mm dia tubing, GI/MS, upto 4.50 M long with 90° bends, 2 nos, with hard wood bushes at both ends, necessary clamps, bolts etc, without cross arms, supply and fixing. | Each | 9645 |
| 25-652 | Same as item 25-651, but 6 M long. | Each | 11280 |
| 25-653 | Same as item 25-651, but fixing only. | Each | 3069 |
| 25-654 | Same as item 25-652, but fixing only. | Each | 3274 |
| 25-655 | Add to item 25-651 or 25-653, if removal only. | Each | 2277 |
| 25-656 | Add to item 25-652 or 25-654, if removal only. | Each | 2429 |
| 25-657 | **Stay Wire** 3/1O SWG or 7/16 SWG upto 7 metre in length, complete with clamp and anchor bolts for service bracket, supply and fixing. | Each | 2647 |
| 25-658 | Same as item 25-657, but above 7 metre and upto 10 M. | Each | 3584 |
| 25-659 | Same as item 25-657 or 25-658, but fixing only. | Each | 409 |
| 25-660 | Add to item 25-657 to 25-659, if removal only. | Each | 286 |
| 25-661 | **Steel Box** (16 BG) for main switch, distribution board and meter, Type A, as per drawing in Figure 25-14, duly painted with primer and two coats of synthetic enamel paint, supply and fixing. | Each | 8365 |
| 25-662 | Same as item 25-662, but **Type B** | Each | 4404 |
| 25-663 | Same as item 25-662 to 25-663, but fixing only. | Each | 174 |
| 25-664 | Add to item 25-662 to 25-664, if removal only. | Each | 122 |
| 25-665 | **Fuse Aerial Porcelain** up to 30 A, supply and fixing. | Each | 538 |
| 25-666 | Same as item 25-665, but 60 A. | Each | 564 |
| 25-667 | Same as item 25-665 or 25-667, but fixing only. | Each | 205 |
| 25-668 | Add to item 25-665 to 25-667, if removal only. | Each | 143 |
| 25-669 | **Box guard MS,** 10 SWG, supply and fixing. | Each | 281 |
| 25-670 | Same as item 25-669, but 8 SWG. | Each | 302 |
| 25-671 | Same as item 25-669, but 6 SWG. | Each | 359 |
| 25-672 | Same as item 25-669 to 25-671, but fixing only. | Each | 123 |
| 25-673 | Add to item 25-669 to 25-672, if removal only. | Each | 86 |
| 25-674 | **Cradle guard,** 8 SWG for HT, supply and fixing. | Each | 192 |
| 25-675 | Same as item 25-674, but fixing only. | Each | 102 |
| 25-676 | Add to item 25-674 or 25-675, if removal only. | Each | 72 |
| 25-677 | **Cable marker,** supply and fixing. | Each | 1456 |
| 25-678 | Same as item 25-677, but fixing only. | Each | 256 |
| 25-679 | Add to item 25-677 or 25-678, if removal only. | Each | 179 |
| 25-680 | **Jumpring,** 8 SWG copper conductor, supply and fixing. | Each | 340 |
| 25-681 | Same as item 25-680, but 6 SWG. | Each | 466 |
| 25-682 | Same as item 25-680, but 4 SWG. | Each | 583 |
| 25-683 | Same as item 25-680, but 2 SWG. | Each | 779 |
| 25-684 | Same as item 25-680, but 1 SWG. | Each | 916 |
| 25-685 | Same as item 25-680, but 1/0 SWG. | Each | 1060 |
| 25-686 | Same as item 25-680, but 2/0 SWG. | Each | 1172 |
| 25-687 | Same as item 25-680, but 3/0 SWG. | Each | 1424 |
| 25-688 | Same as item 25-680, but 4/0 SWG. | Each | 1523 |
| 25-689 | Same as item 25-680, but 70 $mm^2$. | Each | 1390 |
| 25-690 | Same as item 25-680, but 95 $mm^2$. | Each | 1918 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-691 | Same as item 25-680, but 120 $mm^2$. | Each | 2357 |
| 25-692 | Same as item 25-680, but 150 $mm^2$. | Each | 2992 |
| 25-693 | Same as item 25-680 to 25-682, but fixing only. | Each | 205 |
| 25-694 | Same as item 25-683 to 25-686, but fixing only. | Each | 348 |
| 25-695 | Same as item 25-687 to 25-689, but fixing only. | Each | 409 |
| 25-696 | Same as item 25-690, but fixing only. | Each | 512 |
| 25-697 | Same. as item 25-691, but fixing only. | Each | 614 |
| 25-698 | Same as item 25-692, but fixing only. | Each | 819 |
| 25-699 | Add to item 25-680 to 25-692 or 25-693 to 25-698, if removal only. | Each | 164 |
| | **Power Transformer** | | |
| 25-700 | Supply and erection in position on steel / PCC platform and connecting up, including testing and commissioning **Power Transformer,** step down 11000/400/230 V, 3 phase 50 cycles indoor/outdoor, 25 KVA **Type "A"** (excluding cost of platform). | Each | 286332 |
| 25-701 | Same as item 25-700, but 25 KVA Type "B". | Each | 256812 |
| 25-702 | Same as item 25-700, but 25 KVA Type "C". | Each | 193632 |
| 25-703 | Same as item 25-700, but 50 KVA, Type "A". | Each | 436092 |
| 25-704 | Same as item 25-700, but 50 KVA Type "B". | Each | 355092 |
| 25-705 | Same as item 25-700, but 50 KVA Type "C". | Each | 284892 |
| 25-706 | Same as item 25-700, but 100 KVA, Type "A". | Each | 623292 |
| 25-707 | Same as item 25-700, but 100 KVA Type "B". | Each | 523572 |
| 25-708 | Same as item 25-700, but 100 KVA Type "C". | Each | 466092 |
| 25-709 | Same as item 25-700, but 150 KVA, Type "A". | Each | 838458 |
| 25-710 | Same as item 25-700, but 150 KVA Type "B". | Each | 673038 |
| 25-711 | Same as item 25-700, but 150 KVA Type "C". | Each | 567738 |
| 25-712 | Same as item 25-700, but 200 KVA, Type "A". | Each | 1051578 |
| 25-713 | Same as item 25-700, but 200 KVA Type "B". | Each | 799398 |
| 25-714 | Same as item 25-700, but 200 KVA Type "C". | Each | 680058 |
| 25-715 | Same as item 25-700, but 250 KVA, Type "A". | Each | 1264887 |
| 25-716 | Same as item 25-700, but 250 KVA Type "B". | Each | 865647 |
| 25-717 | Same as item 25-700, but 250 KVA Type "C". | Each | 781408 |
| 25-718 | Same as item 25-700, but 300 KVA Type "A". | Each | 1478196 |
| 25-719 | Same as item 25-700, but 300 KVA Type "B". | Each | 917856 |
| 25-720 | Same as item 25-700, but 300 KVA Type "C". | Each | 889776 |
| 25-721 | Same as item 25-700, but 400 KVA, Type "A". | Each | 1898676 |
| 25-722 | Same as item 25-700, but 400 KVA Type "B". | Each | 1374156 |
| 25-723 | Same as item 25-700, but 400 KVA Type "C". | Each | 1320276 |
| 25-724 | Same as item 25-700, but 500 KVA, Type "A". | Each | 2224788 |
| 25-725 | Same as item 25-700, but 500 KVA Type "B". | Each | 1544748 |
| 25-726 | Same as item 25-700, but 500 KVA Type "C". | Each | 1478388 |
| 25-727 | Same as item 25-700, but 630 KVA, Type "A". | Each | 2550900 |
| 25-728 | Same as item 25-700, but 630 KVA Type "B". | Each | 1673220 |
| 25-729 | Same as item 25-700, but 630 KVA Type "C". | Each | 1560900 |
| 25-730 | Same as item 25-700, but 1000 KVA, Type "A". | Each | 3040500 |
| 25-731 | Same as item 25-700, but 1000 KVA Type "B". | Each | 2059332 |
| 25-732 | Same as item 25-700, but 1000 KVA Type "C". | Each | 1930500 |
| 25-733 | Same as item 25-700 to 25-702, but fixing only. | Each | 4092 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-734 | Same as item 25-703 to 25-705, but fixing only. | Each | 4092 |
| 25-735 | Same as item 25-706 to 25-708, but fixing only. | Each | 4092 |
| 25-736 | Same as item 25-709 to 25-711, but fixing only. | Each | 6138 |
| 25-737 | Same as item 25-712 to 25-714, but fixing only. | Each | 6138 |
| 25-738 | Same as item 25-715 to 25-717, but fixing only. | Each | 9207 |
| 25-739 | Same as item 25-718 to 25-720, but fixing only. | Each | 12276 |
| 25-740 | Same as item 25-721 to 25-723, but fixing only. | Each | 12276 |
| 25-741 | Same as item 25-724 to 25-726, but fixing only. | Each | 14433 |
| 25-742 | Same as item 25-727 to 25-729, but fixing only. | Each | 16500 |
| 25-743 | Same as item 25-730 to 25-732, but fixing only. | Each | 16500 |
| 25-744 | Add to item 25-700 to 25-708 or 25-733 to 25-735 if removal only. | Each | 4092 |
| 25-745 | Add to item 25-709 to 25-714 or 25-736 to 25-737, if removal only. | Each | 6138 |
| 25-746 | Add to item 25-715 to 25-717 or 25-738, if removal only. | Each | 9207 |
| 25-747 | Add to item 25-718 to 25-723 or 25-739 to 25-740, if removal only. | Each | 12?.76 |
| 25-748 | Add to item 25-724 to 25-726 or 25-741, if removal only. | Each | 16500 |
| 25-749 | Add to item 25-727 to 25-732 or 25-742 to 25-743, if removal only. | Each | 16500 |
| | **Power Transformers - Pad Mounted** | | |
| 25-750 | Supply, fixing, testing and commissioning of Power Transformer pad mounted type, oil immersed, naturally cooled, step down 11000/400/230 and | Each | 831570 |
| 25-751 | Same as item 25-750, but 25 KVA, Type "B". | Each | 408444 |
| 25-752 | Same as item 25-750, but 25 KVA, Type "C". | Each | 322092 |
| 25-753 | Same as item 25-728, but 50KVA, Type "A". | Each | 998332 |
| 25-754 | Same as item 25-750, but 50 KVA, Type "B". | Each | 572712 |
| 25-755 | Same as item 25-750, but 50 KVA, Type "C". | Each | 468492 |
| 25-756 | Same as item 25-728, but 100KVA, Type "A". | Each | 1165650 |
| 25-757 | Same as item 25-750, but 100 KVA, Type "B". | Each | 902652 |
| 25-758 | Same as item 25-750, but 100 KVA, Type "C". | Each | 695292 |
| 25-759 | Same as item 25-728, but 150KVA, Type "A". | Each | 1400695 |
| 25-760 | Same as item 25-750, but 150 KVA, Type "B". | Each | 1057092 |
| 25-761 | Same as item 25-750, but 150 KVA, Type "C | Each | 1027608 |
| 25-762 | Same as item 25-728, but 200KVA, Type "A". | Each | 1735334 |
| 25-763 | Same as item 25-750, but 200 KVA, Type "B". | Each | 1269738 |
| 25-764 | Same as item 25-750, but 200 KVA, Type "C". | Each | 1255698 |
| 25-765 | Same as item 25-728, but 250KVA, Type "A". | Each | 2124492 |
| 25-766 | Same as item 25-750, but 250 KVA, Type "B". | Each | 13539 78 |
| 25-767 | Same as item 25-750, but 250 KVA Type "C". | Each | 1190538 |
| 25-768 | Same as item 25-728, but 300 KVA, Type "A". | Each | 2322150 |
| 25-769 | Same as item 25-750, but 300 KVA Type "B". | Each | 1437336 |
| 25-770 | Same as item 25-750, but 300 KVA Type "C". | Each | 1314276 |
| 25-771 | Same as item 25-728, but 400 KVA, Type "A". | Each | 2707048 |
| 25-772 | Same as item 25-750, but 400 KVA Type "B". | Each | 2048076 |
| 25-773 | Same as item 25-750, but 400 KVA Type "C". | Each | 1734276 |
| 25-774 | Same as item 25-728 but 500 KVA, Type "A". | Each | 3298907 |
| 25-775 | Same as item 25-750, but 500 KVA Type "B". | Each | 2415228 |
| 25-776 | Same as item 25-750, but 500 KVA Type "C". | Each | 1904388 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-777 | Same as item 25-728, but 630 KVA, Type "A". | Each | 3733461 |
| 25-778 | Same as item 25-750, but 630 KVA Type "B". | Each | 2613900 |
| 25-779 | Same as item 25-750, but 630 KVA Type "C". | Each | 2114100 |
| 25-780 | Same as item 25-728, but 1000 KVA, Type "A". | Each | 4523818 |
| 25-781 | Same as item 25-750, but 1000 KVA Type "B". | Each | 3173388 |
| 25-782 | Same as item 25-750, but 1000 KVA Type "C". | Each | 2892588 |
| 25-783 | Same as item 25-750 to 25-752, but fixing only. | Each | 4092 |
| 25-784 | Same as item 25-753 to 25-755,, but fixing only. | Each | 4092 |
| 25-785 | Same as item 25-756 to 25-758, but fixing only. | Each | 4092 |
| 25-786 | Same as item 25-759 to 25-761, but fixing only. | Each | 4092 |
| 25-787 | Same as item 25-762 to 25-764, but fixing only. | Each | 6138 |
| 25-788 | Same as item 25-765 to 25-767, but fixing only. | Each | 12276 |
| 25-789 | Same as item 25-768 to 25-770, but fixing only. | Each | 12276 |
| 25-790 | Same as item 25-771 to 25-773, but fixing only. | Each | 12276 |
| 25-791 | Same as item 25-774 to 25-776, but fixing only. | Each | 14388 |
| 25-792 | Same as item 25-777 to 25-779, but fixing only. | Each | 16350 |
| 25-793 | Same as item 25-780 to 25-782, but fixing only. | Each | 16350 |
| 25-794 | Add to item 25-750 to 25-761 or 25-783 to 25-786, if removal only. | Each | 3069 |
| 25-795 | Add to item 25-762 to 25-767 or 25-787 to 25-788, if removal only. | Each | 4092 |
| 25-796 | Add to item 25-768 to 25-770 or 25-789, if removal only. | Each | 9207 |
| 25-797 | Add to item 25-771 to 25-773, or 25-790, if removal only. | Each | 9207 |
| 25-798 | Add to item 25-774 to 25-776, or 25-791, if removal only. | Each | 10791 |
| 25-799 | Add to item 25-777 to 25-782, or 25-792 to 25-793, if removal only. | Each | 12263 |
| | **DRY TYPE TRANSFORMER INSULATION CLASS "F° COPPER WINDING** | | |
| 25-800 | Supply, erection, Installation, Testing and Commissioning of Dry type indoor, power transformer having continuous rating of 11000/400/230 volt, 3 phase, 50 HZ, having off load tap changing arrangement on high voltage side. The taping to be provided for variation of high voltage from -10% to +5% in seven step of 2.5% each, for "F" Class insulation, Copper winding Capacity 100 KVA. | Each | 3088092 |
| 25-801 | Same as Item 25-800 but capacity 200 KVA. | Each | 3414138 |
| 25--802 | Same as Item 25-800 but capacity 400 KVA. | Each | 4488276 |
| 25-803 | Same as Item 25-800 but capacity 500 KVA. | Each | 4814388 |
| 25-804 | Same as Item 25-800 but capacity 630 KVA. | Each | 4934338 |
| 25-805 | Same as Item 25-800 but capacity 800 KVA. | Each | 5222388 |
| 25-806 | Same as Item 25-800 but capacity 1000 KVA. | Each | 6722388 |
| | **DRY TYPE TRANSFORMER INSULATION CLASS "F" Aluminium WINDING** | | |
| 25-807 | Supply, erection, Installation, Testing and Comrn1ss1ornng of Dry type indoor, power transformer having continuous rating of 11000 400/230 volt, 3 phase, 50 HZ, having off load tap changing arrangement on high voltage side. The taping to be provided for variation of high voltage from -10% to +5% in seven step of 2.5% each, for "F" Class insulation, Aluminium winding Capacity 100 KVA. | Each | 2380092 |
| 25-808 | Same as Item 25-807 but capacity 200 KVA. | Each | 2574138 |
| 25-809 | Same as Item 25-807 but capacity 400 KVA. | Each | 2928276 |
| 25-810 | Same as Item 25-807 but capacity 500 KVA. | Each | 3374388 |
| 25-811 | Same as Item 25-807 but capacity 630 KVA. | Each | 3746388 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-812 | Same as Item 25-807 but capacity 800 KVA. | Each | 4070388 |
| 25-813 | Same as Item 25-807 but capacity 1000 KVA. | Each | 4238388 |
| 25-814 | Same as Item 25-800 to 25-807 but fixing only. | Each | 4092 |
| 25-815 | Same as Item 25-801 or 25-808 but fixing only. , | Each | 6138 |
| 25-816 | Same as Item 25-802 or 25-809 but fixing only. | Each | 12276 |
| 25-817 | Same as Item 25-803 or 25-810 but fixing only. | Each | 14388 |
| 25-818 | Same as Item 25-804 or 25-811 butfixing only. | Each | 16500 |
| 25-819 | Same as Item 25-805 or 25-812' but fixing only. | Each | 16500 |
| 25-820 | Same as Item 25-806 or 25-813 but fixing only. | Each | 16500 |
| 25-821 | Add to item 25-800, 25-807 or 25-814 if removal only. | Each | 3039 |
| 25-822 | Add to item 25-801, 25-808 or 25-815 if removal only. | Each | 4603 |
| 25-823 | Add to item 25-802, 25-809 or 25-816 if removal only. | Each | 6138 |
| 25-824 | Add to item 25-803, 25-810 or 25-817 if removal only. | Each | 10791 |
| 25-825 | Add to item 25-804, 25-811 or 25-818 if removal only. | Each | 10791 |
| 25-826 | Add to item 25-805, 25-812 or 25-819 if removal only. | Each | 10791 |
| 25-827 | Add to item 25-806, 25-813 or 25-820 if removal only. | Each | 10791 |
| | **Transformer Single Phase** | | |
| 25-828 | Supply, fixing and erection in position on steel/PCC platform and connecting up, including testing and commissioning Power Transformer, step down 11000/230 V, **single phase,** 50 cycles, indoor/outdoor, 25 KVA (excluding cost of platform). | Each | 244092 |
| 25-829 | Same as item 25-828, but 50 KVA. | Each | 334092 |
| 25-830 | Same as item 25-828, but 100 KVA. | Each | 502092 |
| 25-831 | Same as item 25-828, but fixing only. | Each | 4092 |
| 25-832 | Same as item 25-829, but fixing only. | Each | 4092 |
| 25-833 | Same as item 25-830, but fixing only. | Each | 4092 |
| 25-834 | Add to item 25-828 to 25-833 if removal only. | Each | 4092 |
| | **Potential Transformer** | | |
| 25-835 | **Potential Transformer (PT),** 11000 / 230 V or 110 V, for HT panel, supply and fixing. | Each | 73023 |
| 25-836 | Same as item 25-835, but fixing only. | Each | 1023 |
| 25-837 | Add to item 25-835 or 25-836, if removal only. | Each | 716 |
| | **HT / LT Current Transformers (CT)** | | |
| 25-838 | **Current Transformer (CT),** Ratio 25/5, 35/5 or 75/5 A, for HT panel, supply and fixing. | Each | 57471 |
| 25-839 | Same as item 25-838, but CT Ratio 100/5 A | Each | 49983 |
| 25-840 | Same as item 25-838, but CT Ratio 25/5 A for LT panel. | Each | 2432 |
| 25-841 | Same as item 25-838 but CT Ratio 35/5 A to 1000/5 A, for LT panel. | Each | 5792 |
| 25-842 | Same as item 25-838 to 25-839, but fixing only | Each | 1023 |
| 25-843 | Same as item 25-840 to 25-841, but fixing only. | Each | 512 |
| 25-844 | Add to item 25-838 to 25-843, if removal only. | Each | 512 |
| | **LT Switch Board with MCCB** | | |
| 25-845 | LT Switch Board with 1250 A, MCCB, incoming switch, complete with thermal over current release, adjustable magnetic short circuit release, shunt trip coil, CT ratio 1000/5, volt meter and Amp-meter with selector switches, earth fault relays, complete with TP, neutral common bus bar, including upto 06 outgoing with neutral link, 3-Phase MCCB switches, switch board steel sheet factory wired, painted and installed, complete including making connection, supply and fixing. | Each | 612883 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-846 | Same as item 25-845, but 1000 A, upto 05 outgoings. | Each | 570307 |
| 25-847 | Same as item 25-845, but 800 A, upto 04 outgoing. | Each | 457486 |
| 25-848 | Same as item 25-845, but 600 A, upto 04 outgoing. | Each | 371889 |
| 25-849 | Same as item 25-845, but 400 A, upto 03 outgoing. | Each | 276448 |
| 25-850 | Same as item 25-845 to 25-848, but fixing only. | Each | 6204 |
| 25-851 | Same as item 25-849, but fixing only. | Each | 4653 |
| 25-852 | Add to item 25-845 to 25-851, if removal only. | Each | 3069 |
| | **LT Panel without MCCB** | | |
| 25-853 | LT Panel without MCCB, ACB etc complete with digital Ampere, volts meters, Selector switches, Indication lamps, 3 x current transformers, cable Gland, copper bus bar, 3 phase and neutral link, including proper nuts and bolts with spring washers mounted on proper insulator, Electrical interlocking, steel sheet powder coated 3 mm thick, switch for operation on 3 phase, 4 wire, 50 cycles 400-600 volts, 100 Amps. Supply & Fixing. | Each | 29943 |
| 25-854 | Same as Item 25-853, But up to 150 Amps. | Each | 31043 |
| 25-855 | Same as Item 25-853, But up to 300 Amps. | Each | 41652 |
| 25-856 | Same as Item 25-853, But up to 400 Amps. | Each | 41723 |
| 25-857 | Same as Item 25-853, But up to 500 Amps. | Each | 47309 |
| 25-858 | Same as Item 25-853, But up to 750 Amps. | Each | 125106 |
| 25-859 | Same as Item 25-853, But up to 1000 Amps. | Each | 140038 |
| 25-860 | Same as Item 25-853, But up to 1200 Amps. | Each | 149034 |
| 25-861 | Same as item 25-853 to 25-854 but fixing only. | Each | 2925 |
| 25-862 | Same as item 25-855 to 25-857 but fixing only. | Each | 3525 |
| 25-863 | Same as item 25-858 to 25-859 but fixing only. | Each | 6204 |
| 25-864 | Add to item 25-853 to 25-854 or 25-861 and if removal only. | Each | 1463 |
| 25-865 | Add to item 25-855 to 25-857 or 25-862 if removal only. | Each | 2291 |
| 25-866 | Add to item 25-858 to 25-859 or 25-863 if removal only. | | 4653 |
| | **Voltage Regulator** | | |
| 25-867 | **Auto Voltage Regulator (AVR),** AC 380-400/220-230 V, 3 phase, 50 cycles, suitable for un-balanced load, capable of delivering steady output voltage upto variation of+ 1%, complete with voltmeter and selection switch, pilot lamps and potentiometer, capacity 30 KVA with upto + 20% variation on input voltage, **(EU Origin),** supply and fixing. | Each | 1960486 |
| 25-868 | Same as item 25-867, but 72 KVA. | Each | 3594250 |
| 25-869 | Same as item 25-867, but 100 KVA. | Each | 4974697 |
| 25-870 | Same as item 25-867, but 150 KVA. | Each | 6122748 |
| 25-871 | Same as item 25-867, but 220 KVA. | Each | 7037038 |
| 25-872 | Same as item 25-867, but 300 KVA. | Each | 8390047 |
| 25-873 | Same as item 25-867, but 450 KVA. | Each | 10096538 |
| 25-874 | Same as item 25-867 to 25-868, but fixing only. | Each | 2046 |
| 25-875 | Same as item 25-869 to 25-871, but fixing only. | Each | 3274 |
| 25-876 | Same as item 25-872 to 25-873, but fixing only. | Each | 5640 |
| 25-877 | Add to item 25-867 to 25-868 or 25-874 if removal only. | Each | 1432 |
| 25-878 | Add to item 25-869 to 25-871 or 25-875 if removal only. | Each | 2292 |
| 25-879 | Add to item 25-872 to 25-873 or 25-876 if removal only. | Each | 3948 |
| | **Voltage Regulator** | | |
| 25-880 | **Auto Voltage Regulator (AVR) Servo Control Type,** Input 3 Phase + neutral 380 VAC, Input voltage range ±25% (from 285 V, AC~475 VAC), output voltage, 3 phase, 380 V, AC, rms stabilized, output voltage ,accuracy ±1~2%, frequency 50/60 Hz, 5% admitted load variation 0-100%, | Each | 226174 |

| SI No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | admitted load unbalance upto 100%, correction speed 12ms/v, wave form distortion, <1%, max failure range, <±1%, efficiency, >98%, cooling, air cooled with fan, operating temperature -10°C to +60°C, relative humidity not more than 90%, storage temperature -20°C to +60°C, over load 200% for 02 Sec, distortion less than 01%, power factor 0.8, Instrumentation input & output complete with volt and amp meters with selection switches, suitable rated input / output terminal blocks / busbars, all standard protections at input & output MCCBs (Eu Brand), paint colour light Grey (RAL 7035), capacity 1O KVA, (Pak Made ), Supply and Fixing. | | |
| 25-881 | Same as item 25-880 but 15 KVA. | Each | 338494 |
| 25-882 | Same as item 25-880 but 20 KVA. | Each | 415714 |
| 25-883 | Same as item 25-880 but 30 KVA. | Each | 672846 |
| 25-884 | Same as item 25-880 but 50 KVA. | Each | 928686 |
| 25-885 | Same as item 25-880 but 72 KVA. | Each | 1249710 |
| 25-886 | Same as item 25-880, but 100 KVA. | Each | 1572142 |
| 25-887 | Same as item 25-880, but 150 KVA. | Each | 2259108 |
| 25-888 | Same as item 25-880, but 220 KVA. | Each | 3197738 |
| 25-889 | Same as item 25-880, but 300 KVA. | Each | 4181462 |
| 25-890 | Same as item 25-880, but 400 KVA. | Each | 5587592 |
| 25-891 | Same as item 25-880 to 25-882 but fixing only. | Each | 1535 |
| 25-892 | Same as item 25-883 to 25-885 but fixing only. | Each | 2046 |
| 25-893 | Same as item 25-886 to 25-888 but fixing only. | Each | 3274 |
| 25-894 | Same as item 25-889 to 25-890 but fixing only. | Each | 5640 |
| 25-895 | Add to item 25-880 to 25-882 or 25-891 if removal only. | Each | 1074 |
| 25-896 | Add to item 25-883 to 25-885 or 25-892 if removal only. | Each | 1432 |
| 25-897 | Add to item 25-886 to 25-888 or 25-893 if removal only. | Each | 2292 |
| 25-898 | Add to item 25-889 to 25-890 or 25-894 if removal only. | Each | 3948 |
| | **Road / Street Lights** | | |
| 25-899 | **Bracket for Road/Street/External light** (MS/GI pipe), supply and fixing. | Each | 2059 |
| 25-900 | Same as item 25-899, but fixing only. | Each | 246 |
| 25-901 | Add to item 25-899 or 25-900, if removal only. | Each | 172 |
| | **Earth for Transformers** | | |
| 25-902 | **Special Earth for transformers,** HT and LT, switchgear for areas having water table upto 3M depth, supply and fixing vide Para 25.4 of Specifications. | Each | 19039 |
| 25-903 | Same as item 25-902, but for areas having water table more than 3 M depth, supply and fixing only. | Each | 22752 |
| 25-904 | Same as item 2§-902, but for areas having water table more than 6 M upto 12 M depth, supply and fixing only. | Each | 53414 |
| 25-905 | Same as item 25-902 to 25-904, but fixing only. | Each | 7620 |
| 25-906 | Add to item 25-902 to 25-905, if removal only. | Each | 930 |
| | **VCBs** | | |
| 25-907 | Vacuum Circuit Breaker (VCB), HT 11 KV, panel floor mounting, 400/630 A, rating 25 KA, 17.5 KV complete with selector switches, indicating lamps, spring Charging motor 220 V AC, 50ms DC closing coil 110 V DC, 50ms DC Trip Coil 11O V, CT, PT, Earth fault, over current, short circuit, current digital relay, frequency meter, amp meter, volt meter, capacitor trip unit, MCB 06 A, SP, charging handle, push button, mounted in sheet steel cubicle, factory assembled duly painted, single panel unit complete with energy meter, MDI & KVARH complete in all respect. | Each | 1697208 |
| 25-908 | Same as item 25-907 but one incoming and two outgoing (set of three). | Each | 5066808 |
| 25-909 | Same as item 25-907, but two incoming and one outgoing (set of three) | Each | 5066808 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | including all protections and arrangement for incoming supply sources and locking device system, electrical and mechanical interlocking as per manufacturer's specifications. | | |
| 25-910 | Same as item 25-907 to 25-909, but fixing only. | Each | 12408 |
| 25-911 | Add to item 25-907 to 25-909 or 25-910, if removal only. | Each | 5729 |
| 25-912 | **KWH+ MDI and KVARH combined meter HT Panel,** supply and fixing. | Each | 72060 |
| 25-913 | Same as item 25-912 but fixing only. | Each | 1860 |
| 25-914 | Add to item 25-912 or 25-913 if removal only. | Each | 1395 |
| 25-915 | **Feeder Pillar Cabin,** size 600 x 450 x 900 mm, made of steel sheet (14 BG) and angle iron frame size 38 x 38 mm, with water resistance, hinged cover having locking arrangement, duly painted of approved quality, consisting of hard drawn insulated copper bus-bars 4 nos, capacity 800 - 1000 A, mounted on good quality porcelain base/cleats with brass nut / bolts off sizes, drilled holes of appropriate size for inlets and outlets cables, e rthing jointing system, foundation of PCC 1:2:4 and suitable arrangement for ,breakers incoming and out-going, (excluding cost of breaker) , supply and fixing. | Each | 57204 |
| 25-916 | Same as item 25-915, but 400 - 600 A. | Each | 48001 |
| 25-917 | Same as item 25-915, but 200 - 300 A. | Each | 43789 |
| 25-918 | Same as item 25-915 to 25-917, but fixing only. | Each | 686 |
| 25-919 | Add to item 25-915 to 25-917 or 25-918, if removal only. | Each | 259 |
| | **PG Clamp** | | |
| 25-920 | PG Clamp 25 mm size, Aluminium with proper GI nuts, bolts and spring washer, Supply & Fixing. | Each | 183 |
| 25-921 | Same as Item 25-920, but 50 mm. | Each | 247 |
| 25-922 | Same as Item 25-921, but 75 mm. | Each | 531 |
| 25-923 | PG Clamp 25 mm size Bimetal copper/Aluminium for jointing of copper cable with Aluminium conductor or Aluminium cable with copper, conductor of proper GI nuts, bolts and spring washer, Supply & Fixing. | Each | 987 |
| 25-924 | Same as Item 25-923 but 50 mm. | Each | 1280 |
| 25-925 | Same as Item 25-923 but 75 mm. | Each | 1933 |
| 25-926 | Same as Item 25-920 or 25-923 but fixing. | Each | 86 |
| 25-927 | Same as Item 25-921 to 25-924 but fixing. | Each | 104 |
| 25-928 | Same as Item 25-922 or 25-925 but fixing. | Each | 121 |
| 25-929 | Add to item 25-920 to 25-928 if removal only. | Each | 86 |
| | **Bus Tie Ducts** | | |
| 25-930 | Bus Tie Ducts Copper, 1000 A, TP & N Made out of 14 SWG M.S Sheet Steel painted with electro static powder coated paint RAL-7032 Complete in all respect, supply and fixing. | Metre | 44414 |
| 25-931 | Same as item 25-930 but 1250 A, TP & N. | Metre | 59439 |
| 25-932 | Same as item 25-930 but 1600 A, TP & N. | Metre | 70824 |
| 25-933 | Same as item 25-930 but 2000 A, TP & N. | Metre | 109108 |
| 25-934 | Same as item 25-930 but 2500 A, TP & N. | Metre | 132544 |
| 25-935 | Same as item 25-930 but 3200 A, TP & N. | Metre | 174698 |
| 25-936 | Same as item 25-930, 25-933, but fixing only. | Metre | 465 |
| 25-937 | Same as item 25-934, 25-935, but fixing only. | Metre | 698 |
| 25-938 | Add to item 25-930 to 25-933 or 25-936 if removal only. | Metre | 349 |
| 25-939 | Add to item 25-934 to 25-935 or 25-937 if removal only. | Metre | 512 |
| | **ATS Panels** | | |
| 25-940 | ATS Panel 10 KVA, ATP & N, Made CD t of 14 SWG M.S Sheet Steel painted with electro static powder coated (paint RAL-7032ATS), Panel Complete in | Each | 96748 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | all respect. Supply & Fixing. | | |
| 25-941 | Same as item 25-940 but 15 KVA, ATS Panels. | Each | 100287 |
| 25-942 | Same as item 25-940 but 20 KVA, ATS Panels. | Each | 105341 |
| 25-943 | Same as item 29-940 but 30 KVA, ATS Panels. | Each | 116801 |
| 25-944 | Same as item 25-940 but 40 KVA, ATS Panels. | Each | 124949 |
| 25-945 | Same as item 25-940 but 50 KVA, ATS Panels. | Each | 139832 |
| 25-946 | Same as item 25-940 but 60 KVA, ATS Panels | Each | 150221 |
| 25-947 | Same as item 25-940 but 75 KVA, ATS Panels. | Each | 164658 |
| 25-948 | Same as item 25-940 but 100 KVA, ATS Panels. | Each | 178137 |
| 25-949 | Same as item 25-940 but 125 KVA, ATS Panels. | Each | 275208 |
| 25-950 | Same as item 25-940 but 150 KVA, ATS Panels. | Each | 311548 |
| 25-951 | Same as item 25-940 but 175 KVA, ATS Panels. | Each | 339628 |
| 25-952 | Same as item 25-940 but 200 KVA, ATS Panels. | Each | 436644 |
| 25-953 | Same as item 25-940 but 250 KVA, ATS Panels. | Each | 490229 |
| 25-954 | Same as item 25-940 but 300 KVA, ATS Panels. | Each | 541163 |
| 25-955 | Same as item 25-940 but 400 KVA, ATS Panels. | Each | 781163 |
| 25-956 | Same as item 25-940 but 500 KVA, ATS Panels. | Each | 1802025 |
| 25-957 | Same as item 25-940 but 600 KVA, ATS Panels. | Each | 1922025 |
| 25-958 | Same as item 25-940 but 700 KVA, ATS Panels. | Each | 1955161 |
| 25-959 | Same as item 25-940 to 25-943, but fixing only. | Each | 465 |
| 25-960 | Same as item 25-944 to 25-946, but fixing only. | Each | 698 |
| 25-961 | Same as item 25-947 to 25-949, but fixing only. | Each | 814 |
| 25-962 | Same as item 25-950 to 25-952, but fixing only. | Each | 930 |
| 25-963 | Same as item 25-953 to 25-955, but fixing only. | Each | 1162 |
| 25-964 | Same as item 25-956 to 25-958, but fixing only. | Each | 2025 |
| 25-965 | Add to item 25-940 to 25-943 or 25-959 if removal only. | Each | 349 |
| 25-966 | Add to item 25-944 to 25-946 or 25-960 if removal only. | Each | 523 |
| 25-967 | Add to item 25-947 to 25-949 or 25-961 if removal only. | Each | 608 |
| 25-968 | Add to item 25-950 to 25-952 or 25-962 if removal only. | Each | 697 |
| 25-969 | Add to item 25-953 to 25-955 or 25-963 if removal only. | Each | 870 |
| 25-970 | Add to item 25-956 to 25-958 or 25-964 if removal only. | Each | 1418 |
| | **CABLE TRAY** | | |
| 25-971 | Cable tray out of 16 Guage, GI sheet, without cover, complete in jointing plates. Cable tray size 4" x 2". | Metre | 923 |
| 25-972 | Same as item 25-971 but Cable tray size 6" x 2". | Metre | 1071 |
| 25-973 | Same as item 25-971 but Cable tray size 9" x 2". | Metre | 1300 |
| 25-974 | Same as item 25-971 but Cable tray size 12" x3". | Metre | 1797 |
| 25-975 | Same as item 25-971 but Cable tray size 15" x 3". | Metre | 2027 |
| 25-976 | Same as item 25-971 but Cable tray size 18" x 4". | Metre | 2524 |
| 25-977 | Same as item 25-971 but Cable tray size 24" x 4". | Metre | 2981 |
| 25-978 | Same as item 25-971 to 25-973, but fixing only. | Metre | 233 |
| 25-979 | Same as item 25-974 to 25-975, but fixing only. | Metre | 349 |
| 25-980 | Same as item 25-976 to 25-977, but fixing only. | Metre | 465 |
| 25-981 | Add to item 25-971 to 25-973 or 25-978, but fixing only. | Metre | 140 |
| 25-982 | Add to item 25-974 to 25-975 or 25-978, but fixing only. | Metre | 233 |
| 25-983 | Add to item 25-976 to 25-977 or 25-980, but fixing only. | Metre | 349 |

| Sl No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Street Light** | | |
| 25-984 | LED Road Street Ught, 22 Watts, 220-240 Volts, "Standard", complete supply and fixing. | Each | **4428** |
| 25-985 | Same as item 25-984 but Deluxe. | Each | **8928** |
| 25-986 | Same as item 25-984 but Premium. | Each | **15948** |
| 25-987 | Same as item 25-984 but 27 watt Standard. | Each | 5628 |
| 25-988 | Same as item 25-987 but Deluxe. | Each | **9348** |
| 25-989 | Same as item 25-987 but Premium. | Each | **17028** |
| 25-990 | Same as item 25-984 but 50 watt Standard. | Each | **6828** |
| 25-991 | Same as item 25-990 but Deluxe. | Each | **12768** |
| 25-992 | Same as item 25-990 but Premium. | Each | **24228** |
| 25-993 | Same as item 25-984 but 60 watt Standard. | Each | **11628** |
| 25-994 | Same as item 25-993 but Deluxe. | Each | **13128** |
| 25-995 | Same as item 25-993 but Premium. | Each | **19048** |
| 25-996 | Same as item 25-984 but 70 watt Standard. | Each | **10428** |
| 25-997 | Same as item 25-996 but Deluxe. | Each | **21228** |
| 25-998 | Same as item 25-996 but Premium. | Each | **35428** |
| 25-999 | Same as item 25-984 but 90 watt Standard. | Each | **13428** |
| 25-1000 | Same as item 25-999 but Deluxe. | Each | **24892** |
| 25-1001 | Same as item 25-999 but Premium. | Each | **36427** |
| 25-1002 | Same as item 25-984 but 100 & 110 watt Standard. | Each | **31428** |
| 25-1003 | Same as item 25-1002 but Deluxe. | Each | **32628** |
| 25-1004 | Same as item 25-1002 but Premium. | Each | **44328** |
| 25-1005 | Same as item 25-984 but 120 & 130 watt Standard. | Each | **21978** |
| 25-1006 | Same as item 25-1005 but Deluxe. | Each | **34128** |
| 25-1007 | Same as item 25-1005 but Premium. | Each | **41910** |
| 25-1008 | Same as item 25-984 but 140 & 150 watt Standard. | Each | **25728** |
| 25-1009 | Same as item 25-1008 but Deluxe. | Each | **38328** |
| 25-1010 | Same as item 25-1008 but Premium. | Each | **56148** |
| 25-1011 | Same as item 25-984 but 160 & 170 watt Standard. | Each | **27228** |
| 25-1012 | Same as item 25-1011 but Deluxe. | Each | **43428** |
| 25-1013 | Same as item 25-1011 but Premium. | Each | **66648** |
| 25-1014 | Same as item 25-984 but 180 watt Standard. | Each | **38328** |
| 25-1015 | Same as item 25-1014 but Deluxe. | Each | **38388** |
| 25-1016 | Same as item 25-1014 but Premium. | Each | **67038** |
| 25-1017 | Same as item 25-984 to 25-1016 but fixing only. | Each | **960** |
| 25-1018 | Add to item 25-984 to 25-1016 or 25-1017 if removal only. | Each | **518** |
| | **Flood Light** | | |
| 25-1019 | LED Flood Security Light, 30 Watts, 220-240 Volts, approved type "Standard", complete supply and fixing. | Each | 4118 |
| 25-1020 | Same as item 25-1019 but Deluxe. | Each | 5001 |
| 25-1021 | Same as item 25-1019 but Premium. | Each | 15841 |
| 25-1022 | Same as item 25-1019 but 50 watt Standard. | Each | 5541 |
| 25-1023 | Same as item 25-1022 but Deluxe. | Each | 7261 |
| 25-1024 | Same as item 25-1022 but Premium. | Each | 23271 |
| 25-1025 | Same as item 25-1019 but 70 watt Standard. | Each | 10221 |
| 25-1026 | Same as item 25-1025 but Deluxe. | Each | 12381 |

| 51 No. | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 25-1027 | Same as item 25-1025 but Premium. | Each | 24021 |
| 25-1028 | Same as item 25-1019 but 100 & 110 watt Standard. | Each | 11142 |
| 25-1029 | Same as item 25-1028 but Deluxe. | Each | 22322 |
| 25-1030 | Same as item 25-1028 but Premium. | Each | 36473 |
| 25-1031 | Same as item 25-1019 but 120 watt Standard. | Each | 12622 |
| 25-1032 | Same as item 25-1031 but Deluxe. | Each | 20422 |
| 25-1033 | Same as item 25-1031 but Premium. | Each | 27022 |
| 25-1034 | Same as item 25-1019 but 160 watt Standard. | Each | 16822 |
| 25-1035 | Same as item 25-1034 but Deluxe. | Each | 21782 |
| 25-1036 | Same as item 25-1034 but Premium. | Each | 34222 |
| 25-1037 | Same as item 25-1019 but 200 watt Standard. | Each | 18022 |
| 25-1038 | Same as item 25-1037 but Deluxe. | Each | 28622 |
| 25-1039 | Same as item 25-1037 but Premium. | Each | 45622 |
| 25-1040 | Same as item 25-1019 but 220 watt Standard. | Each | 29422 |
| 25-1041 | Same as item 25-1040 but Deluxe. | Each | 48022 |
| 25-1042 | Same as item 25-1040 but Premium. | Each | 68422 |
| 25-1043 | Same as item 25-1019 but 245 watt Standard. | Each | 45622 |
| 25-1044 | Same as item 25-1043 but Deluxe. | Each | 63022 |
| 25-1045 | Same as item 25-1043 but Premium. | Each | 91582 |
| 25-1046 | Same as item 25-1019 but 315 watt Stanqard. | Each | 55822 |
| 25-1047 | Same as item 25-1046 but Deluxe. | Each | 64222 |
| 25-1048 | Same as item 25-1046 but Premium. | Each | 66022 |
| 25-1049 | Same as item 25-1019 but 350 watt Standard. | Each | 66622 |
| 25-1050 | Same as item 25-1049 but Deluxe. | Each | 72022 |
| 25-1051 | Same as item 25-1049 but Premium. | Each | 78622 |
| 25-1052 | High Bay Light LED, 100 watt, stiff pendent 220-240 Volts, approved type, ceiling mounted round type "Standard", complete supply and fixing. | Each | 22582 |
| 25-1053 | Same as item 25-1052 but Deluxe. | Each | 26062 |
| 25-1054 | Same as item 25-1052 but Premium. | Each | 31702 |
| 25-1055 | Same as item 25-1052 but 150 watt Standard. | Each | 22462 |
| 25-1056 | Same as item 25-1055 but Deluxe: | Each | 42622 |
| 25-1057 | Same as item 25-1055 but Premium. | Each | 43054 |
| 25-1058 | Same as item 25-1019 to 25-1057 but fixing only. | Each | 388 |
| 25-1059 | Add to item 25-1019 to 25-1057 or 25-1058 if removal only. | Each | 388 |

# SECTiON-26

# NATURAL GAS

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-26

# NATURAL GAS

## SPECIFICATIONS

**26.0.** This section covers all operations for provision of Natural gas and appliances. Specifications related to Mild Steel (MS), Polyethylene, High pressure/ Low pressure pipes, valves, fittings, water heater, cooking range and accessories etc have been elaborated.

### 26.1. General

26.1.1. All Natural Gas installations shall be carried out strictly in accordance with the specifications / standards laid down by the local Gas Company as amended from time to time.

26.1.2. Gas installation works shall only be entrusted to the Contractor on the approved list of local Gas Company, i.e. Sui Northern Gas Pipelines Ltd (SNGPL) and Sui Southern Gas Pipelines Ltd (SSGPL).

26.1.3. Local Building codes, effective in the area should be given consideration while applying these specifications/ standards.

## MATERIAL REQUIREMENTS

### 26.2. High Pressure Gas Pipe Work (MS)

26.2.1. All High-pressure gas pipes plain end shall be MS black tubes of API 5L Grade "B" standard with specifications given in Table 26-1:-

**TABLE 26-1**

**MS Pipes (High Pressure) - Specifications**

| Nominal Bore mm | Wall Thickness mm | **Weight Plain End (Kg /M)** | Test **Pressure Kg/ Sq. cm.** |
|---|---|---|---|
| 20 | 2.87 | 1.70 | 49.00 |
| 25 | 3.38 | 2.52 | 49.00 |
| 50 | 3.91 | 5.42 | 77.00 |
| 100 | 6.02 | 16.02 | 91.00 |
| **150** | 7.11 | 28.22 | 91.00 |
| 200 | 8.18 | 42.65 | 110.00 |

26.2.2. All High-pressure gas piping shall be of welded construction and be tested at pressure specified by the Gas Company.

26.2.3. A double layer of bitumen with Fibre glass is provided for MS pipe of 100 mm dia and above, whereas less dia with single layer.

### 26.3. Low Pressure Gas Pipe Work

26.3.1. Pipe used in internal installation (house piping) shall conform to BS 1387 'Medium grade' or equivalent as per Table 26-2:-

**TABLE 26-2**

**GI Pipes (Low Pressure) - Specifications**

| **Nominal Bore mm** | **Gauge** | **Wall thickness** mm | **Weight of black tube** | |
|---|---|---|---|---|
| | | | **Plain End Kg/M** | **Screwed & Socketed Kg/M** |
| 15 | 12 | 2.65 | 1.22 | 1.23 |
| 20 | 12 | 2.65 | 1.58 | 1,59 |
| 25 | 10 | 3.25 | 2.44 | 2.46 |
| 32 | 10 | 3.25 | 3.14 | 3.17 |
| 40 | 10 | 3.25 | 3.61 | 3.65 |
| 50 | 9 | 3.65 | 5.10 | 5.17 |

26.3.2. All low-pressure internal gas piping may be of screwed connection. Reduction in sizes should be with reduction tees, elbows or reducers. All changes in direction should preferably be made with the use of fittings. For this purpose pipe shall not be bent or set, as far as possible. If it becomes necessary, then special care is taken to avoid sharp bends and off-sets, particularly for GI pipes.

26.3.3. For other technical details on Low-Pressure pipes, refer to tables given in Section - 18-1.

**26.4. Medium Density Polyethylene (MOPE) Pipes.** MOPE (T-flex) High Pressure Gas quality pipes sizes 20-63 mm dia are available in 100 M coil length and above 63 mm in 12 M length. It conforms to Standards ISO 4437, (DIN 8074) ASTM D-2513 (DIN 8075) given in Tables 26-3 and 26-4:-

**TABLE 26-3**

**MOPE Pipe Dimensions** (ISO 4437)

| Nominal Outside dia, mm | Min Wall thickness, mm | |
|---|---|---|
| | SOR 17.6 | SOR 11 |
| 20 | 2.3 | 3.0 |
| 25 | 2.3 | 3.0 |
| 32 | 2.3 | 3.0 |
| 40 | 2.3 | 3.7 |
| 50 | 2.9 | 4.6 |
| 63 | 3.6 | 5.8 |
| 75 | 4.3 | 6.8 |
| 110 | 6.3 | 10.0 |
| 125 | 7.1 | 11.4 |
| 160 | 9.1 | 14.6 |
| 180 | 10.3 | 16.4 |

**TABLE 26-4**

**Dimensions** (ASTM O 2513)

| Pipe Size mm (in) | Outside Dia mm (in) | Tolerance for Max. / Min. out of Roundness SOR 17/ SOR 13.5/ SOR 11 | Wall Thickness and Tolerance | | |
|---|---|---|---|---|---|
| | | | SOR | Min. mm (in) | Tolerance mm (in) |
| 19 (¾") | 26.7 (1.050) | ±0.254 (±0.0100) | 11 | 2.41 (0.095) | +0.279 (+0.011) |
| 25 (1") | 33.4 (1.315) | ±0.254 (±0.010) | 11 | 3.02 (0.119) | +0.356 (+0.014) |
| 31 (1¼") | 42.1 (1.660) | ±0.305 (±0.012) | 11 | 3.84 (0.151) | +0.457 (+0.018) |
| 38 (1½") | 48.3 (1.900) | ±0.305 (±0.012) | 11 | 4.39 (0.173) | +0.533 (+0.021) |
| 50 **(2")** | 60.3 (2.375) | ±0.305 (±0.012) | 11 | 5.49 (0.216) | +0.660 (+0.026) |
| 63 (2 ½") | 73.02 (2.875) | ±0.381 (±0.015) | 11 | 6.63 (0.261) | +0.787 (+0.031) |
| 75 (3") | 88.9 (3.500) | ± 0.381 (±0.015) | 11 | 8.08 (0.318) | +0.965 (+0.038) |
| 100 (4") | 114.3 (4.5) | ± 0.381 (±0.015) | 11 | 10.39 (0.409) | +1.246 (+0.049) |
| 150 (6") | 168.3 (6.625) | ± 0.889 (±0.035) | 11 | 15.29 (0.602) | +1.829 (+0.072) |

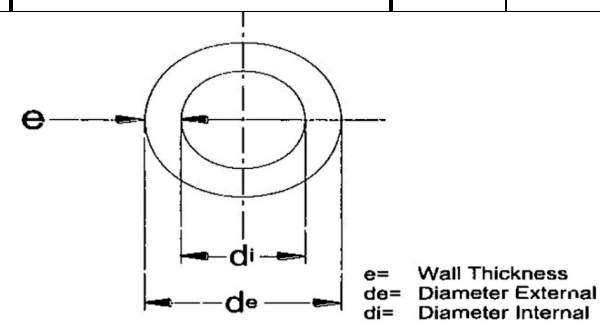



**TABLE 26-5**

**Maximum Operating Pressure (Bars)**

| Temperature °C | PN6 | PNB | PN10 | PN16 |
|---|---|---|---|---|
| 20 | 6 | 8 | 10 | 16 |
| 30 | 3.2 | 7.3 | 8 | 13 |
| 40 | 2 | 6.7 | 6 | 11 |
| 50 | 1.6 | 5.7 | 4 | 8 |
| 60 | 1 | 4.8 | 3.2 | 6 |

**26.5. Butt Fusion/ Electro-Fusion Fittings.** End Cap, Equal Tee, Reducer, 45° / 90° Elbow, Stub Flange, Coupler.

## 26.6. Materials

26.6.1. **Gas Equipment** used in gas installation will be of a make or type as approved by the E-in-C from time to time.

26.6.2. Malleable iron galvanized screw fittings used for internal house line installation shall be in accordance with the specifications of BS 143. Malleable iron fittings screwed, British Standard taper thread, shall be of dimension in accordance with Table 26-1.

26.6.3. **Valve and Cocks**

26.6.3.1. Low pressure cocks shall conform to the requirements of BSS-1552 "control plug cocks for low pressure". Lock wing pattern plug type cocks shall be of locking type so that the gas supply can be locked off, if desired. Manifold cock or burner cock shall be of the rigid-key or drop fan key type.

26.6.3.2. All cocks shall be made of brass, gun metal or equally suitable copper base alloy. If manufactured by hot pressings, all cocks shall be of brass, manganese, bronze or equally suitable copper based alloy. Locally manufactured cocks shall be used in domestic and commercial gas piping installation work, only if approved by the Engineer-in-Charge.

## CONSTRUCTION REQUIREMENTS

## 26.7. High Pressure Gas Pipe Work (MS)

26.7.1. All gas pipes, when laid underground shall be located in a manner, so as to be at least 300 mtn away from other services and minimum earth cover of 750 mm shall be provided. These pipes shall be coated and wrapped with Fibre glass.

26.7.2. For coating and ·wrapping the exterior of pipe to be coated should first be thoroughly cleaned of all oil, grease, dirt, rust, moisture or any other foreign substance. As far as practicable, immediately after cleaning, pipe surface should be covered with bituminous primer leaving about 75 mm from either end. Primer should be applied after ascertaining that pipe surface to be covered is thoroughly dry and clean as primer will not stick to wet and dirty surfaces. Primer should be applied thin. Primer should be dry before enamel (doped) is applied soon after this. Hot bituminous enamel at least 1.5 mm thick should be applied and a layer of Fibre glass simultaneously embedded in the enamel to a depth or approximately half the enamel thickness. This in turn should be followed by another coat of enamel (dope) preferably in the opposite direction at least 1.5 mm thick, for less than 100 mm dia pipe. Before applying enamel, care should be taken to see that primer is not dead. This can be tested by scraping the finger nail over the primer and see if it flakes off. If it happens, the surface of the pipe should be repainted, as enamel does not stick over dead primer. Bituminous enamel should be slowly heated to its application temperature of 120°-150°c.

## 26.8. Low Pressure Pipe Work

26.8.1. All exposed pipes be firmly clamped and adequately supported. Pipe clamp shall also be fixed near the bends to avoid any lateral movement. The clamped pipe must rigidly hang with the wall to which it is clamped. Spacing of support in piping installation should not be greater than the following:-

| | | |
|---|---|---|
| (1) | 15 mm | 2.5 M |
| (2) | 25 mm & 80 mm | 3 M |
| (3) | 100 mm to 150 mm | 4.M |
| (4) | 150 mm (horizontal) | 5 M |
| (5) | Larger than 25 mm (vertical) | every floor level· |

26.8.2. A control valve (emergency shut-off valve) should be provided on each of the gas pipe line connecting to the internal pipe work of the building. This valve should be installed outside the building along with the building wall at a height of about 150 mm to 225 mm. Under no circumstances it should be concealed. It should be readily accessible in case of emergency for shutting off gas supply to the building, if the operating pressure upto this value is 0.6 Kg/Sq.cm. in closed position.

26.8.3. To reduce the pressure from max 0.6 Kg/ Sq.cm. to 150 mm Water Column (we), suitable regulator will be required which should be installed outside the building as a safeguard against any possible release of gas from the built-in relief valves. The gas fired equipment shall be installed at a location where facilities for ventilation permit satisfactory combustion of gas and proper vent under normal conditions of use. For this purpose natural draft chimney or a mechanical exhaust may be provided. For each gas fired-equipment, a plug type control valve or bait valve should be installed to enable the equipment to be disconnected in case gas supply is not required. A union should be installed just outside/inside the building so that equipment can easily be dismantled, if required.

## 26.9. Medium Density Polyethylene Gas Pipes (MOPE)

26.9.1. **Jointing Methods.** Two most commonly used jointing methods are Butt-Fusion Method and Electro-Fusion Method.

26.9.1.1. **Butt f=usion Method. A** method of joining MOPE like (T-Flex) pipes where two pipe ends are heated to a molten state, and brought together to form a homogeneous bond. For long lasting and reliable fusion, only pipes and fittings of same size, MRS and SOR* rating should be used.

•standard Dimension Ratio (SDR) = $\frac{\text{Average Outside Diameter}}{\text{Minimum Wall Thickness}}$

26.9.1.1.1. **Preparation (for Butt Fusion Joints).** Following points be ensured **(Do's):-**

(1) Check that dia, Standard Dimension Ratio (SOR), Polymer (MRS) are same.
(2) Check all equipment is clean and in good working condition.
(3) Ensure that the pipe is undamaged.
(4) Check fuel for generator (where applicable).
(5) Check fusion conditions for pipe to be welded.
*(6)* Carry out dummy fusion to clean heating plate (where needed).

26.9.1.1.2. Following points be avoided **(Don't's):-**

(1) Welding in wet or windy condition without protection of welding equipment.
(2) Removing pipe from clamp before cooling period is complete.
(3) Using dirty or contaminated pipe.
(4) Using Butt Fusion equipment being not fully trained to do so.

26.9.1.1.3. **General Procedure - (Butt Fusion Installation)**

(1) Ensure that the pipes to be joined are of same diameter, SOR and polymer.
(2) If necessary, pipe and fittings should be washed with clean water and wiped with paper before clamping in machine.
(3) The pipe ends must be reasonably square cut. If not, re-cut pipe ends after pipe is cleaned with moist cloth and dried.
(4) At the start of each working day (welding session), the cold heater plate should be cleaned with moist cloth and dried.
(5) Check to ensure that the Butt fusion equipment is clean and in working order, the correct size clamp inserts are available and heater plate is up to working temperature.
(6) To avoid any risk of contamination at site, place Butt fusion machine on a clean base board or tarpaulin.
(7) If the weather is windy or wet, jointing should be carried out inside a protective shelter.
(8) To prevent cooling of heater plates from air drafts, the pipe ends should be plugged or covered before welding commences.
(9) Before jointing commences, the fusion pressure and fusion time should be established for the pipes being jointed. The information should be attached to the fusion machine, or contact Technical Department of the manufacturer to obtain fusion data.
(10) Check that the generator has sufficient fuel to last for the jointing cycle.

26.9.2. **Electro-Fusion Method.** The jointing technique is based on sleeve coupler with an integrated coil. The pipe ends that are to be joined are placed in the coupler and electrical current is passed through the coil. As wire resistance generates heat, the material of coupler and pipe melts to fuse with each other.

26.9.2.1. **Preparation for Electro Fusion Joints**

26.9.2.1.1. Following points be ensured **(Do's):-**

(1) Cut pipe ends square and deburr.
(2) Scrape pipe ends.
(3) Use correct restraining clamps.
(4) Set correct fusion and cooling times.
(5) Check fuel for generator (where applicable).

26.9.2.1.2. Following points be avoided **(Don'ts):-**

(1) Use of sandpaper/emery cloth etc for cleaning pipe ends.
(2) Touch crapped pipe ends or inside of fittings.
(3) Make joints wet and rephrase unless adequate protection is provided.
(4) Stop the fusion cycle mid way.
(5) Touch the fusion indicator until the fitting has cooled.
(6) Move joints before fully cooled.
(7) Remove the fitting from the plastic bag till the time it is actually required.

26.9.2.2. **General Procedure - (Electro Fusion Installation)**

(1) **Clean.** Use a clean, dry, lint free cloth or paper towel and wipe loose dirt off the pipe ends.

(2) **Scrape.** Using an approved mechanical or handheld scraper, scrape each pipe in excess of half a socket length. Ensure the entire surface layer is removed. Do not touch pipe ends after scraping.

(3) **Mark.** Using molded depth of entry mark and the fitting as a guide, clearly mark the depth of entry on the pipes.

(4) **Align.** Remove the fitting from bag and assemble on the pipes up to the central stop. At this point an approved disposable wipe may be used to clean pipe ends and bore of the fitting. Otherwise, do not touch inside of the fitting.

(5) **Clamp.** Position pipes and fittings into the clamp. Check that pipes are in line. Fully tighten both restraining clamps.

(6) **Fuse.** Connect the fusion box electrical wires to the fitting terminals. Press start and ensure that the joint complete its full Fusion cycle (indicated by movement of Fusion Indicator.)

(7) **Cool.** Leave the joint in clamp for cooling till the required time as marked on each fitting. Check that the Fusion Indicator has moved.

## 26.10. Location of Gas Appliances

26.10.1. Gas appliance shall not be installed in a location, where flammable vapours or explosive mixtures are likely to be present.

26.10.2. Service connection shall be provided at a point on the boundary of consumer's premises nearest to the existing gas mains keeping in view drive ways, CI mains, water tanks, soakage pits and any other underground structures. Service shall not be located in a closed space or any other place where it may be subject to damage or which in the opinion of Gas Company is unsafe. Service shall not be provided unless boundary wall has been constructed at least in the section where the service is to be provided.

26.10.3. Decision of Company regarding the location and space requirements shall be final.

26.10.4. Gas Meter shall be located at adequately ventilated space not farther than 1.5 M horizontal distance from the service, unless this is impracticable and another location is approved by the company. This does not apply to a case, where one service feeds more than one consumer and the meter is located nearest to the points of fabrication of gas piping, leading to respective consumers.

26.10.5. **Multiple Meter Installation.** Gas piping for multiple meter installation shall be plainly marked by the tags, as approved by the Engineer-in-Charge and attached by the contractor at his own cost with designation, particulars of house or flat being supplied.

**26.11. Sizing of House Piping.** Gas piping shall be of such size, and so installed, as to provide adequate gas supply to meet max demand without any undue loss of pressure between the gas pressure regulator and the appliances. Max demand shall be based on the consumption of all appliances.

## 26.12. House Piping Installation

26.12.1. Piping shall be according to the sketch or plan approved by the Gas Company. Any deviation or alteration shall be subject to the prior approval of the Gas Company.

26.12.2. Building structure shall not be weakened by the installation of any gas piping. Before any beams or joint or pillars are cut or notched, permission in writing must be obtained from the Engineer-in-Charge.

26.12.3. Gas piping as far as possible shall not pass through habitable or closed rooms. However, in case where it is unavoidable, section of gas piping through such spaces shall be without joints and shall contain least number of fittings.

26.12.4. The gas piping shall not touch any existing building or site for future construction, nor through manholes, drains or other underground structures.

26.12.5. The ends of all gas piping shall be reamed. Jointing compound shall be of approved type and applied only to male threads of the joints.

26.12.6. Gas piping shall not be re-supported by any other piping but shall be installed with supports of sufficient strength and quality at proper intervals so that the piping cannot be moved accidentally from the installed position.

## 26.13. Underground Piping

26.13.1. Min depth of 750 mm shall be provided. Pipe other than GI shall be protected against corrosion by use of bitumen and Hessian cloth, Fibre glass or PVC tape. Threaded portion shall also be protected in the same manner as mentioned above.

26.13.2. Piping in concrete floors and passages shall have a clear top cover of 50 mm. If practicable, channel for pipe in concrete floor shall be cut along a joint or seam. Special care shall be exercised in locations where vehicles are likely to move across the gas piping. Steel pipe shall not be used unless properly coated and wrapped.

**26.14. Concealed Piping.** Pipe smaller than 20 mm dia shall not be used in any location. However, if the extension involved be less than 3 Meter and the expected gas consumption not higher than 0.56 cum per hour, 15 mm dia piping may be used.

**26.15. Location of Gas Points**

26.15.1. Plugged points shall be left 15 mm clear from floors, walls and ceilings to permit use of proper tools. In case of concealed piping or points provided through walls, female threads should be fully clear of the wall.

26.15.2. Until the connection of appliances to the gas point is made, all provided points proved shall be securely capped or plugged and physically disconnected from the section of piping carrying gas.

**26.16. Shut-off Cocks**

26.16.1. In multiple flat/dwelling buildings supplied through a bulk meter or one service regulator, an individual shut-off cock for each riser or separate houseline shall be provided at a convenient point of general accessibility. In all such cases, where the meter is installed inside the flat, a lock wing type plug cock shall be provided in the houseline before the gas installation piping enters consumer's premises.

26.16.2 **Meter Control Cock.** Lock wing pattern plug cock shall be installed at inlet of each meter in case of multiple dwelling establishments.

26.16.3. **Manifold Cock. A** plug type control cock shall be installed at a convenient height in the gas piping just above the manifold piping connecting appliances to the system. Burner control cock, if not provided as an integral part, shall be installed for each burner or appliance.

**26.17. Appliances Installation**

26.17.1. All appliances shall be connected directly to the gas piping with fire resident rigid pipe and fittings.

26.17.2. Gas applications shall be adequately supported and so connected to the piping as not to exert undue strain on connections.

26.17.3. Every gas appliance shall be located with respect to building construction and other equipment to permit access to the appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces, adjustments and cleaning of burners and pilots.

26.17.4. Domestic gas burners and cookers shall have clearance above the cooking top of not less than 750 mm to combustible material of metal cabinets. When the underside is protected with Asbestos millboard, at least 3 mm thick, and the distance shall be more than 600 mm.

26.17.5. All Appliances shall be installed in level. Appliances of the following types shall be provided with a flue pipe for removing flue gases to the outside atmosphere:-

(1) Water heaters with inputs over 5000 BTUs per hour, except, auto controlled instantaneous water heaters, which supply water to a single faucet, attached to and made part of the appliance.

(2.) Room heaters.

(3) Baking Ovens.

26.17.6. Gas vent or chimney shall be engineered and constructed to develop a positive flow, adequate to remove all flue gases to outside atmosphere. The gas vent or chimney, if connected to single appliance, shall not be less than size of flue pipe of the appliance.

26.17.7. Following appliances do not require to be vented:-

(1) Cookers and burners.

(2) Specialized equipment of limited input such as laboratory burners.

(3) Gas light.

**26.18. Water Heaters (Geysers, dual action geysers and instant gas geyser).**

26.18.1. Water heaters shall not be installed in bedrooms or any occupied room, normall,y kept closed. These shall be installed outside.

26.18.2. Water heaters shall be connected in a manner to permit observation, maintenance and servicing. No storage water heater shall be installed in a closed system of water piping, unless an approved water pressure relief valve or an expansion pipe in the system is provided.

26.18.3. The water supply to any auto instant water heater shall be such as to provide sufficient pressure to properly operate the water actuator control valve, when drawing hot water from a faucet on the top floor.

26.18.4. Water heater may only be installed inside a room provided that:-

(1) The volume of the room is not less than 0.93 cum per 1000 Btu/hr input to the water heater. When the room is directly connected to another room or space by door, which cannot be closed, the volume of such a room or space may be included for this purpose.

(2) The bathroom has two ventilators, one within 150 mm to 225 mm from the floor and the other at a min height of 300 mm above top of the water heater, which cannot be closed. The area of these ventilators shall not be less than 6.50 Sq.cm/ 1000 Btu/hr input to the water heater.

## 26.19. Inspection, Testing and Commissioning

### 26.19.1. Inspection and Testing

26.19.1.1. Before turning gas under pressure into any piping, all openings from which gas can escape, shall be closed. Before turning gas into the house piping the system shall be pressurized to 500 mm water column (w.c) with air and checked by one of the following methods to ascertain that no gas is escaping:-

(1) **Checking for leakage using gas meter.** Checking for leakage can be done carefully watching the test dial of the meter to determine whether gas is passing through the meter. In case careful observation of the test hand reveals no movement for a sufficient length of time, the piping shall be purged and a small gas burner turned on and lighted. The hand of the test dial is again observed. If the dial hand moves (as it should) it will show that the meter is operating properly. If the test hand does not move or register flow of gas through the meter, it is defective and it should be replaced.

(2) **Checking for leakage using a "U" gauge.** This can be done by attaching a 'U' Gauge calibrated so that it can read in division increments of 2 mm water column and momentarily turning on the gas supply and observing the gauge for the pressure drop with the gas supply shut off. No discernible drop in pressure shall occur during a period of 10 minutes. If the meter test hand moves, or a pressure drop on the gauge is noted, all appliance outlets supplied through the system shall be examined to see if they are shut off and do not leak. If they are found shut, there is a leak in the piping system. The gas supply shall be shut off until necessary repairs have been made after which the piping shall be subjected again to the pressure test.

### 26.19.2. Commissioning

26.19.2.1. After the piping has been checked all piping receiving gas shall be fully purged. Under no circumstances shall the piping be purged into the combustion chamber of an appliance. After the piping has been sufficiently purged, appliances shall be purged and pilots, if any, lighted.

26.19.2.2. Each burner shall be adjusted to its proper gas rate in accordance with the manufacturer's instructions. Over rating of the burner is prohibited. The burner gas rate can be checked with test hand on the meter. The gas rate shall be adjusted to the required rate by changing a fixed orifice. The primary air shall be adjusted for proper flame characteristics.

26.19.2.3. All protective devices furnished with the appliance shall be checked to ensure proper operation.

26.19.2.4. When an auto pilot is provided, it shall be checked for proper operation and adjustment in accordance with the manufacturer's instructions. If the pilot does not function properly to turn off the gas supply in the event of pilot outage it shall be properly serviced or replaced with new equipment.

26.19.2.5. All appliances connected to a fluepipe shall be operated for a few minutes and checked to see that the products of combustion are being expelled properly by passing a lighted match around the edge of opening of the draft hood. If the fluepipe is drawing properly the match flame will be drawn in the draft hood. If not the product of combustion will tend to extinguish this flame, if the products of combustion are escaping from the opening, the appliance shall not be operated until proper adjustments or repairs are made to **ensure** adequate draft through the flue pipe of vent.

26.19.2.6. At the time of commissioning new installations or extension of gas piping work, consumer shall be instructed by demonstration as to how to operate the appliance safely. Instructions regarding cleaning of appliance shall be given before leaving the premises.

## METHOD OF MEASUREMeNTS

**26.20.** Pipe work generally shall be measured:-

26.20.1. Net overall length of pipes and fitting as fixed, except, where otherwise described.

26.20.2. Fittings shall be enumerated, except where otherwise described.

26.20.3. MOPE Gas Quality pipe is considered without any kind of Fusion joint as well as fittings, which will be accounted for separately, as required.

## CLARIFICATION OF RATES

**26.21.** The rates, inter alia, include particularly:-

(1) Fixing complete in long and short lengths.

(2) Fixing of High pressure pipes:-

(a) Laid complete in trenches after cleaning, welding, applying primer coating with, BBES compound and wrapping with Fibre glass (excluding excavation).

(b) Making good surfaces disturbed.

(c) Forming all necessary holes for making good.

(3) Fixing of Low Pressure pipes:-

(a) Fixing to wall/roof/floor/pillar etc. Complete with pipe hooks.

(b) Making good surfaces disturbed.

(c) Forming all necessary holes and making good.

(4) Cuts in new mains.

(5) Testing of High Pressure/ Low Pressure pipes.

(6) Turning on the supply.

(7) All jointing materials as required.

(8) Butt Fusion / Electro-Fusion joint and fittings will be measured separately for payment (for MDPE pipe)

**26.22.** Low-Pressure pipe work (Medium grade) shall be paid under appropriate Schedule items described in Section 18-1.

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Sui Gas - Pipe Work** | | |
| 26-1 | **M.S Pipe** for high pressure, including cleaning, applying primer, coating with **BBES** (Bitumen Binding Enamel Surface) compound and wrapping with **fibre glass,** welding, complete 20 mm dia, laid in trenches (excluding excavation), supply and fixing. | Metre | 823 |
| 26-2 | Same as item 26-1, but 25 mm dia. | Metre | 1080 |
| 26-3 | Same as item 26-1, but 50 mm dia. | Metre | 1454 |
| 26-4 | Same as item 26-1, but 100 mm dia, **double** wrapping with fiber glass | Metre | 3300 |
| 26-5 | Same as item 26-4, but 150 mm dia. | Metre | 4685 |
| 26-6 | Same as item 26-1, but fixing only. | Metre | 203 |
| 26-7 | Same as item 26-2, but fixing only. | Metre | 225 |
| 26-8 | Same as item 26-3, but fixing only. | Metre | 248 |
| 26-9 | Same as item 26-4, but fixing only. | Metre | 270 |
| 26-10 | Same as item 26-5, but fixing only. | Metre | 293 |
| 26-11 | Add to item 26-1 or 26-6, if removal only. | Metre | 152 |
| 26-12 | Add to item 26-2 or 26-7, if removal only. | Metre | 169 |
| 26-13 | Add to item 26-3 or 26-8, if removal only. | Metre | 186 |
| 26-14 | Add to item 26-4 or 26-9, if removal only. | Metre | 203 |
| 26-15 | Add to item 26-5 or 26-10, if removal only. | Metre | 219 |
| | **Gas Valves/ Cocks** | | |
| 26-16 | Eclipse valve 20 mm dia, supply and fixing. | Each | 1094 |
| 26-17 | Same as item 26-16, but 25 mm dia. | Each | 2568 |
| 26-18 | Same as item 26-16, but fixing only. | Each | 41 |
| 26-19 | Same as item 26-17, but fixing only. | Each | 48 |
| 26-20 | Add to item 26-16 or 26-18, if removal only. | Each | 31 |
| 26-21 | Add to item 26-17 or 26-19, if removal only. | Each | 36 |
| 26-22 | Audco Valve, 20mm dia, supply and fixing. | Each | 1174 |
| 26-23 | Same as item 26-22, but 25 mm dia. | Each | 1803 |
| 26-24 | Same as item 26-22, but 50 mm dia. | Each | 6394 |
| 26-25 | Same as item 26-22, but fixing only. | Each | 41 |
| 26-26 | Same as item 26-23, but fixing only. | Each | 48 |
| 26-27 | Same as item 26-24, but fixing only. | Each | 76 |
| 26-28 | Add to item 26-22 or 26-25, if removal only. | Each | 31 |
| 26-29 | Add to item 26-23 or 26-26, if removal only. | Each | 36 |
| 26-30 | Add to item 26-24 or 26-27, if removal only. | Each | 57 |
| 26-31 | **Brass cock,** Union type, gas quality, 15 mm dia, supply and fixing. | Each | 484 |
| 26-32 | Same as item 26-31, but 20 mm dia. | Each | 821 |
| 26-33 | Same as item 26-31, but 25 mm dia. | Each | 1068 |
| 26-34 | Same as item 26-31, but fixing only. | Each | 35 |
| 26-35 | Same as item 26-32, but fixing only. | Each | 41 |
| 26-36 | Same as item 26-33, but fixing only. | Each | 48 |
| 26-37 | Add to item 26-31 or 26-34, if removal only. | Each | 26 |
| 26-38 | Add to item 26-32 or 26-35, if removal only. | Each | 31 |
| 26-39 | Add to item 26-33 or 26-36, if removal only. | Each | 36 |
| 26-40 | **Brass valve,** ball type screwed both ends complete with steel handle, washer/ nut 15 mm dia, supply and fixing. | Each | 443 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 26-41 | Same as item 26-40, but 20 mm dia. | Each | 515 |
| 26-42 | Same as item 26- 40, but 25 mm dia. | Each | 708 |
| 26-43 | Same as item 26- 40, but 40 mm dia. | Each | 2119 |
| 26-44 | Same as item 26- 40, but 50 mm dia. | Each | 2916 |
| 26-45 | Same as item 26- 40, but 65 mm dia. | Each | 6584 |
| 26-46 | Same as item 26-40, but fixing only. | Each | 35 |
| 26-47 | Same as item 26-41, but fixing only. | Each | 41 |
| 26-48 | Same as item 26-42, but fixing only. | Each | 48 |
| 26-49 | Same as item 26-43, but fixing only. | Each | 69 |
| 26-50 | Same as item 26-44, but fixing only. | Each | 86 |
| 26-51 | Same as item 26-45, but fixing only. | Each | 104 |
| 26-52 | Add to item 26-40 or 26-46, if removal only. | Each | 26 |
| 26-53 | Add to item 26-41 or 26-47, if removal only. | Each | 31 |
| 26-54 | Add to item 26-42 or 26-48, if removal only. | Each | 36 |
| 26-55 | Add to item 26-43 or 26-49, if removal only. | Each | 52 |
| 26-56 | Add to item 26-44 or 26-50, if removal only. | Each | 69 |
| 26-57 | Add to item 26-45 or 26-51, if removal only. | Each | 86 |
| | **Tandoor Burner** | | |
| 26-58 | Tandoor burner (48 nozzles), complete with burner plate, regulator /manifold etc., supply and fixing. | Each | 5798 |
| 26-59 | Same as item 26-58, but fixing only. | Each | 518 |
| 26-60 | Add to item 26-58 or 26-59, if removal only. | Each | 388 |
| 26-61 | Plate for 48 nozzles Tandoor burner, supply and fixing. | Each | 2573 |
| 26-62 | Same as item 26-61, but fixing only. | Each | 259 |
| 26-63 | Add to item 26-61 or 26-62, if removal only. | Each | 194 |
| | **Gas Water Heater** | | |
| 26-64 | Gas water heater of 12 SWG Black Sheet (Inner tank), complete with burner pilot, thermostat and safety valve, 68 lit capacity, supply and fixing. | Each | 20318 |
| 26-65 | Same as item 26-64, but 136 lit capacity of 10 SWG Black Sheet (Inner tank). | Each | 27758 |
| 26-66 | Same as item 26-64, but 225 lit capacity of 10SWG Black sheet (inner tank). | Each | 32280 |
| 26-67 | Same as item 26-64, but 455 lit capacity of 10SWG Black sheet (inner tank). | Each | 105990 |
| 26-68 | Dual action Gas cum electric water heater of 12 SWG Black Sheet (Inner tank), complete with burner pilot, thermostat and safety valve, with Electric Element & Electric thermostat 68 lit capacity, supply and fixing. | Each | 28769 |
| 26-69 | Same as item 26-64, but 136 lit capacity of 10 SWG Black Sheet (Inner tank). | Each | 32303 |
| 26-70 | Same as item 26-64, but 225 lit capacity of 10 SWG Black sheet (inner tank). | Each | 36315 |
| 26-71 | Same as item 26-64 to 26-65, 24-68, 24-69 but fixing only. | Each | 518 |
| 26-72 | Same as item 26-66 to 26-67, 24-70, but fixing only. | Each | 690 |
| 26-73 | Add to item 26-64 to 26-65 or 26-71, if removal only. | Each | 388 |
| 26-74 | Add to item 26-66 to 26-67 or 26-72, if removal only. | Each | 518 |
| 26-75 | Instant Gas water heater, complete with burner pilot, Ignition coil Operated DC 1.5 Volt Battery and safety valve, 6 lit per min capacity, supply and fixing. | Each | 11625 |
| 26-76 | Same as item 26-75, but 8 lit per min. | Each | 15225 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 26-77 | Same as item 26-75, but 10 lit per min. | Each | 17145 |
| 26-78 | Same as item 26-75 to 26-77, but fixing only. | Each | 345 |
| 26-79 | Add to item 26-75 to 26-77 or 26-78 if removal only. | Each | 259 |
| 26-80 | Gas light best quality approved type supply and fixing. | Each | 753 |
| 26-81 | Same as item 26-80, but fixing only. | Each | 86 |
| 26-82 | Add to item 26-80 or 26-81 if removal only. | Each | 52 |
| | **Gas Room Heater** | | |
| 26-83 | Gas room heater of 20 SWG Black Sheet, complete with pilot, single burner, supply and fixing. | Each | 6632 |
| 26-84 | Gas room heater of 20SWG Black Sheet, complete with pilot, double burner, supply and fixing. | Each | 8005 |
| 26-85 | Same as item 26-83 to 26-84, but fixing only. | Each | 518 |
| 26-86 | Add to item 26-83 to 26-85, if removal only. | Each | 388 |
| | **Gas Burner (Chullah)** | | |
| 26-87 | Gas burner (Chullah) of 20 SWG Black Sheet, single burner, supply and fixing. | Each | 2257 |
| 26-88 | Same as item 26-87, but double burner. | Each | 3638 |
| 26-89 | Build in burner non Magnetic steel top, one Large super prime burner and 4 medium burner, non-stick paint coated, auto ignition 3, volt battery operated, supply and fixing. | Each | 18734 |
| 26-90 | Same as item 26-89, but Glass Top. | Each | 19706 |
| 26-91 | Build in burner non Magnetic Stainless steel Glass, 2 Large super prime burner and 1 medium burner, non stick paint coated, auto ignition 3 volt battery operated, supply and fixing. | | 13838 |
| 26-92 | Build in burner non Magnetic Stainless steel Glass, 2 Large super prime burner, non stick paint coated auto ignition 3 volt battery operated supply and fixing. | Each | 11030 |
| 26-93 | Same as item 26-87 to 26-92, but fixing only. | Each | 518 |
| 26-94 | Add to item 26-87 to 26-93, if removal only. | Each | 403 |
| | **Gas Cooking Range** | | |
| 26-95 | Gas cooking range of 20 SWG Black Sheet, two burner 27, single door, complete with thermostat, oven, grill, **rotisserie** and tempered (heat-proof) crystal glass, supply and fixing. | Each | 20318 |
| 26-96 | Same as item 26-95, but 34". **3 burner,** double door. | Each | 23678 |
| 26-97 | Same as item 26-95, but 34", **5 burner** single door. | Each | 30704 |
| 26-98 | Same as item 26-95, but **5 burners** double door. | Each | 31958 |
| 26-99 | Same as item 26-95, to 26-98, but fixing only. | Each | 518 |
| 26-100 | Add to item 26-9 to 26-96, if removal only. | Each | 388 |
| 26-101 | **Micro hose** (Fire resistant) 3 feet, long complete with brass coupling on both end supply & fixing. | Each | 3773 |
| 26-102 | Same as item 26-101 but 4 feet long. | Each | 4973 |
| 26-103 | Same as item 26-101 but 6 feet long. | Each | 7373 |
| 26-104 | Same as Item 26-101 to 26-102 but fixing only. | Each | 173 |
| 26-105 | Add to Item 26-101 to 26-102 or 26-103 if removal only. | Each | 138 |
| | **Miscellaneous** | | |
| 26-106 | **Thermostat** of gas water heater complete with thermocouple wire and pilot tube, supply and fixing. | Each | 2678 |
| 26-107 | Same as item 26-106, but fixing only. | Each | 518 |
| 26-108! | Add to item 26-106 or 26-107, if removal only. | Each | 388 |
| 26-109 | **Audco valve,** high pressure, MW-13 type, 100 mm dia flanged with nuts | Each | 12696 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | and bolts, complete, supply and fixing. | | |
| 26-110 | Same as item 26-109, but 150 mm dia. | Each | 30282 |
| 26-111 | Same as item 26-109 to 26-110, but fixing only. | Each | 690 |
| 26-112 | Add to item 26-109 to 26-110 or 26-111, if removal only. | Each | 518 |
| 26-113 | **Muller Tee** 20 mm dia welded, supply and fixing. | Each | 720 |
| 26-114 | Same as item 26-113, but 25 mm dia. | Each | 1536 |
| 26-115 | Same as item 26-113, but 50 mm dia. | Each | 3582 |
| 26-116' | Same as item 26-113 or26-114, but fixing only. | Each | 150 |
| 26-117 | Same as item 26-115, but fixing only. | Each | 244 |
| 26-118 | Add to item 26-113 to 26-117, if removal only. | Each | 112 |
| 26-119 | **Sui gas regulator, "Peeble type",** domestic, supply and fixing. | Each | 1119 |
| 26-120 | Same as item 26-119, but 043 type. | Each | 2079 |
| 26-121 | Same as item 26-119 to 26-120, but fixing only. | Each | 759 |
| 26-122 | Add to item 26-119 to 26-120 or 26-121, if removal only. | Each | 569 |
| | **Sui Gas Meter** | | |
| 26-123 | **Sui gas Meter, domestic,** with brass coupling, supply and fixing. | Each | 6279 |
| 26-124 | **Sui gas Meter, commercial,** complete with brass coupling, supply and fixing. | Each | 20559 |
| 26-125 | Same as item 26-123 to 26-124, but fixing only. | Each | 759 |
| 26-126 | Add to item 26-123 to 26-124 or 26-125, if removal only. | Each | 569 |
| 26-127 | Gas Heater, **flue pipe assembly,** fabricated with 24 gauge, GI sheet, supply and fixing. | Each | 360 |
| 26-128 | Same as item 26-127, but fixing only. | Each | 61 |
| 26-129 | Add to item 26-127 to 26-128, if removal only. | Each | 46 |
| 26-130 | **Locking cock brass,** 20 mm dia, gas quality, supply and fixing. | Each | 691 |
| 26-131 | Same as item 26-130, but fixing only. | Each | 76 |
| 26-132 | Add to item 26-130 or 26-131, if removal only. | Each | 57 |
| | **Poly Ethylene (PE) Gas Pipe** | | |
| 26-133 | **Poly Ethylene (PE) Gas Pipe,** Class **MDPE-80,** Yellow pipe (SDR-11) 20mm dia, without Butt Fusion joint, (excluding cost of excavation), supply and fixing. | Metre | 149 |
| 26-134 | Same as item 26-133, but 25 mm dia. | Metre | 199 |
| 26-135 | Same as item 26-133, but 40 mm dia. | Metre | 309 |
| 26-136 | Same as item 26-133, but 50 mm dia. | Metre | 505 |
| 26-137 | Same as item 26-133, but 75 mm dia. | Metre | 1166 |
| 26-138 | Same as item 26-133, but 100 mm dia. | Metre | 1691 |
| 26-139 | Same as item 26-133, but 160 mm dia. | Metre | 3476 |
| 26-140 | Same as item 26-133, 26-134, but fixing only. | Metre | 69 |
| 26-141 | Same as item 26-135 to 26-137, but fixing only. | Metre | 86 |
| 26-142 | Same as item 26-138, 26-139, but fixing only. | Metre | 173 |
| 26-143 | Add to item 26-133 to 26-134 or 26-140 if removal only. | Metre | 52 |
| 26-144 | Add to item 26-135 to 26-137 or 26-141 if removal only. | Metre | 65 |
| 26-145 | Add to item 26-138 to 26-139 or 26-142 if removal only. | Metre | 129 |
| | **Fitting** | | |
| 26-146 | Butt Fusion joint, for pipe 20 mm dia, joint complete as specified. | Each | 960 |
| 26-147 | Same as item 26-146 but for pipe 25 mm dia. | Each | 960 |
| 26-148 | Same as item 26-146 but for pipe 40 mm dia. | Each | 960 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 26-149 | Same as item 26-146 but for pipe 50 mm or 75 mm dia. | Each | 1200 |
| 26-150 | Same as item 26-146 but for pipe 100 mm dia. | Each | 1800 |
| 26-151 | Same as item 26-146 but for pipe 160 mm dia. | Each | 1800 |
| 26-152 | **Elbow 20 mm** for gas pipe MOPE 80, supply and fixing. | Each | 226 |
| 26-153 | Same as item 26-152 but 25 mm dia. | Each | 635 |
| 26-154 | Same as item 26-152 but 40 mm or 50 mm dia. | Each | 850 |
| 26-155 | Same as item 26-152, but 75 mm dia. | Each | 4684 |
| 26-156 | Same as item 26-152, but 100 mm dia. | Each | 6086 |
| 26-157 | Same as item 26-152, but 160 mm dia. | Each | 20907 |
| 26-158 | **Cap,** 20 mm or 25 mm dia, supply and fixing. | Each | 455 |
| 26-159 | Same as item 26-158, but 40 mm to 50 mm dia. | Each | 635 |
| 26-160 | Same as item 26-158, but 75 mm to 100 mm dia. | Each | 4269 |
| 26-161 | Same as item 26-158, but 160 mm dia. | Each | 11966 |
| 26-162 | **Tee,** 20mm or 25mm dia, supply and fixing. | Each | 370 |
| 26-163 | Same as item 26-162, but 40 mm or 50 mm dia. | Each | 1269 |
| 26-164 | Same as item 26-62, but 75 mm or 100 mm dia. | Each | 4702 |
| 26-165 | Same as item 26-162 but 160 mm dia. | Each | 6753 |
| 26-166 | **Tapping Tee,** Reducing, 25 x 20 mm or 50 x 20 mm dia, supply and fixing. | Each | 1269 |
| 26-167 | Same as item 26-166, but 100 x 20 mm dia. | Each | 4291 |
| 26-168 | Same as item 26-166, but 100 x 25 mm dia. | Each | 5420 |
| 26-169 | Same as item 26-166, but 100 x 50 mm dia. | Each | 5745 |
| 26-170 | Same as item 26-166, but 160 x 25 mm dia. | Each | 5898 |
| 26-171 | Same as item 26-166, but160 x 50 mm dia. | Each | 6001 |
| 26-172 | Same as item 26-152, 26-153, 26-158 or 26-159, but fixing only. | Each | 35 |
| 26-173 | Same as item 26-154, 26-155, 26-160 to 26-163 or 26-166, but fixing only. | Each | 69 |
| 26-174 | Same as item 26-156, 26-157, 26-164, 26-165, 26-167 or 26-168, but fixing only. | Each | 86 |
| 26-175 | Same as item 26-169 to 26-171, but fixing only. | Each | 104 |
| 26-176 | Add to item 26-152, 26-153, 26-158, 26-159 or 26-172, if removal only. | Each | 26 |
| 26-177 | Add to item 26-154, 26-155, 26-160 to 26-163, 26-166 or 26-173, if removal only. | Each | 52 |
| 26-178 | Add to item 26-156, 26-157, 26-164, 26-165, 26-167 or 26-168 or 26-173, if removal only. | Each | 65 |
| 26-179 | Add to item 26-169 to 26-171or 26-174, if removal only. | Each | 78 |
| 26-180 | Multi Gas Detector with Control System to detect gas leakage and automatically shut down gas supply, Provision & fixing. | Each | 36414 |
| 26-181 | Non Industrial at home usage Natural Gas {Methane) Detector with LCD Display Alarm, Supply & Fixing. | Each | 20350 |
| 26-182 | Sensitive Gas Detector, plug in with LCD Display and alarm, supply and fixing. | Each | 2920 |
| 26-183 | Same as Item 26-180 to 26-182 but fixing only. | Each | 144 |
| 26-184 | Add to item 26-180 to 26-182 if removal only. | Each | 72 |

# SECTION-27

# ELECTRO-MECHANICAL EQUIPMENTS

# RECORD OF AMENDMENTS

| SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-27
# ELECTRO-MECHANICAL EQUIPMENT

## SPECIFICATIONS

**27.0.0.** This section covers operations of Electro-mechanical equipment i.e. HVAC (VRV / VRF, Package Units etc.), Elevators, EOT Gantry Cranes, Diesel Generator Sets, Fire Extinguishing System, Public Address System and Medical Gases. All the equipment shall be of approved manufacturers and booking order placed though department. The delivery shall be ensured in the presence of authorized representative of the department.

## SUB SECTION 27-1
## HEATING VENTILATION AND AIR CONDITIONS (HVAC) SYSTEM

### MATERIAL REQUIREMENTS

**27.1.1. GI Ducting.** Shall be constructed of Galvanized sheet steel conforming to ASTM A-366-B2T and Zinc coating shall conform to ASTM 526-64T.

**27.1.2. Diffusers.** Grills and Register shall be fabricated of anodized Aluminium.

**27.1.3. Gate Valves,** Globe valves "Y" strainers and vent valves upto 2 inch shall be bronze and above 2" shall be cast iron.

**27.1.4. Insulation** shall be rockwool or glass wool and density should be 24 Kg/$m^3$.

### CONSTRUCTION REQUIREMENTS

**27.1.5. GI Sheet Metal Duct.** Shall be fabricated according to the Table 27-1 dimension.

**TABLE 27-1**
**Gauge Ducting**

| Large Dimension of Ducting (In) | SWG Gauge GI Sheet | Nominal Thickness (In) |
|---|---|---|
| Upto 8 | 26 | 0.022 |
| 9-27 | **24** | 0.028 |
| 28-51 | **22** | 0.034 |
| 52-81 | 20 | 0.040 |
| Above 81 | 18 | 0.052 |

**27.1.6. Ducts Joints**

27.16.1 **Longitudinal.** Pitts Burg Lock Double Seam or Groove

27.16.2 **Circumferential**

| | |
|---|---|
| Up to 23" | Larger Dimension Drive Slip |
| 24"-42" | 1" High pocket Lock or standing seam |
| 43"-72" | 1-1/2" High Pocket Lock or standing seam |
| 73"-96" | 1-1/2" High pocket lock or standing seam reinforced with bracing angle. |

**27.1.7. Bracing.** The bracing for ducting shall be as per duct of larger dimension as given below:-

(1) 24"-30" - Joints at 4" Centre's with bracing or joint@ 8"C/C
(2) 31"-42" . 1" x 1" x 1/8" @4"C/C
(3) 43"-72" . 1" x 1" x 1/8" @4"C/C
(4) 73"--84" . 1 ½ " x 1- ½ " x 1/8" @4"C/C
(5) 85"-96" . 1 ½ " x 1- ½ " x 1/8" @2"C/C
(6) The 2" centres bracing would be located at joints and between joints. The bracing shall be carried all around four sides and riveted with ducts at maximum 6" centres.

**27.1.8. Bottom Support**

| | |
|---|---|
| (1) Up to 12" width | 1- ¼ " x ¼"MS Flat or 1 ¼ " x 1/8" MS Angle Iron |
| (2) 13" to 30" | 1 ¼ " x 1/8" MS Angle Iron |
| (3) 31" to 72" | 1 ½ " x 1/8" MS Angle Iron |

{4) 73" to 96" 2" x 3/16" MS Angle Iron

**27.1.9. Hanger.** Hanger spacing on average 10'-0" centre with a hanger.

**27.1.10. Special Note for GI Duct**

{1) All un-insulated ducts above 18" to be cross broken.

{2) No Lateral joint to come under beam

(3) Clean all iron works with wire brush and paint with red oxide before fixing.

**TABLE 27-2**
**Insulation for Duct**

| S.No | Service | Thickness | Material | Vapour Barrier | External Covering |
|---|---|---|---|---|---|
| 1 | All supply and return air duct in AHU Unit room and non conditioned areas in side the building | 1" | Fibre glass or Rockwool | 2 ply Kraft paper and aluminium foil with internal fibre glass yarn reinforcement | Coarse cloth covering |
| 2 | Supply and return ducts in return ducts in conditioned areas | **1"** | -do- | -do- | -do- |
| 3 | Ducts exposed to weather (Loe out side the building) | 1-1/2" | -dO- | -do- | (i) Roofing felt 45lbs.<br>(ii) canvas cloth jacketing<br>(iii) 26 gauge aluminium sheet jacketing |

**27.1.11. Method of Measurement**

(1) GI Sheet metal duct, duct insulation and covering to be paid per Sqm.

(2) Grill, diffuser and register will be paid per Sqm.

(3) Valves and fitting will be paid in each No.

**27.1.12. Refrigerant Piping Capabilities**

27.1.12.1 The unit shall be capable of long length of piping and for providing lift of Refrigerant due to level difference between the Outdoor unit and Indoor units at the highest levels.

27.1.12.2 The minimum distance capability of the unit shall be as follows:

(1) Total Piping length of system Max. 300 m.

(2) Actual length in any circuit Max. 150 m.

(3) Equivalent piping length any circuit Max. 175 m.

(4) Level difference between ODU and IOU - Max. 50 m.

**27.1.13. Refrigerant Piping**

27.1.13.1 All refrigerant pipes and fittings shall be type 'L' hard drawn copper tubes and wrought copper fitting suitable for connection with silver solder copper.

27.1.13.2 All joints in copper piping shall be sweat joints using low temperature brazing or silver solder. Before joining any copper pipe or fittings, its interior shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. While construction the joints, subsequently, it shall be thoroughly blown out using carbon dioxide/nitrogen.

27.1.13.3 Refrigerant lines shall be sized to limit pressure drop between evaporator and condensing unit to less than 0.2 kg per Sq.cm.

27.1.13.4 Removable type combination drier and filter shall be installed in liquid line of the refrigeration system incorporating a three way valve bypass. After ninety days of operation, liquid line drier and filter cartridges must be replaced.

27.1.13.5 After the refrigerant piping installation has been completed the refrigerant piping system shall be pressure tested using, Freon mixed with nitrogen/carbon dioxide at a pressure of 20 Kg/ Sqcm, (High side) and 1O Kg/ Sqcm {Low side) pressure shall be maintained on the system for a minimum of 12 hours. The system shall then be evacuated to a minimum vacuum of 70cm. of mercury and held for 24 hours, during which time, change in vacuum shall not exceed 12cm of mercury. Vacuum shall be checked with vacuum gauge.

27.1.13.6 All refrigerant piping shall be installed strictly as per the instructions and recommendations of air conditioning equipment manufacturers.

### 27.1.14. Testing & Balancing

27.1.14.1 All piping shall be tested to hydrostatic test pressure of at least two and half times the maximum operating pressure, but not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified and gotten approved at site.

27.1.14.2 Piping repaired subsequent to the above pressure test shall be retested in the same manner.

27.1.14.3 System may be tested in sections and such sections shall be securely capped, then retested for entire system.

27.1.14.4 The contractor shall give sufficient notice to all other agencies at site, of his intention to test a section or sections of piping and all testing shall be witnessed by Engineer-in-Charge or his representative.

27.1.14.5 The contractor shall make sure that proper noiseless circulation of fluid is achieved through all coils and other heat exchange equipment in the system concerned. If proper circulation is not achieved the contractor shall rectify the defective connection. He shall bear all expenses for carrying out the above rectifications, including the tearing up and refinishing of floors and walls as required.

27.1.14.6 The contractor shall provide all materials, tools, equipment, instruments, services and labour required to perform the test.

27.1.14.7 Complete certified report shall be submitted for evaluation and approval. Upon approval, four copies of the balancing report shall be submitted with complete drawings and documents.

27.1.14.8 The piping thickness shall be as given in Table 27-3 below:

**TABLE 27-3**
**Piping Thickness**

| OD(Inch) | OD (mm) | Min. Wall Thickness (mm) | Soft | Half Hard or Hard |
|---|---|---|---|---|
| 1/4" | 6.35 | 0.80 | | |
| 3/8" | 9.52 | 0.80 | | |
| 1/2" | 12.70 | 0.80 | | |
| 5/8" | 15.88 | 1.00 | | |
| 3/4" | 19.05 | 1.00 | | |
| 7/8" | 22.20 | 1.00 | X | |
| 1-1/8" | 28.58 | 1.00 | X | |
| 1-3/8" | 34.92 | 1.10 | X | |
| 1-5/8" | 41.28 | 1.25 | X | |

27.1.14.9 The branching of refrigerant piping from the main line shall be carried out using either specially designed 'Tee' connectors or 'Y' joints. These joint should ensure that each branch receives the required refrigerant flow.

27.1.14.1 O All pipe sizing shall be on the basis of sizing data of the concerned manufacturer and should ensure adequate oil return back up to the compressor.

**27.1.15. Air Conditioning Systems.** Air conditioning is the process of treating air in an internal environment to establish and maintain required standards of temperature, humidity, cleanliness and movement of air. The use of heating, ventilations and air-conditioning systems (HVAC) is on the increase especially in Hospitals and underground facilities, this sub- section briefly describes various types and major components of modern HVAC system. Detailed specifications and guidelines are covered in technical instructions (Tls) Volume- VI.

**27.1.16. Types of Air-conditioning System.** HVAC system are broadly classified into two categories

27.1.16.1 **All Air System.** In all air system, the refrigerant is in direct contact with air for cooling/ heating purpose generally, the systems comprise of indoor and outdoor units. All systems are further classified as under:

27.1.16.1.1 **Split Type AC.** In this type of system the compressor and condenser are housed in a separate cabinet called condensing unit, which is placed outside the air conditioning space, The evaporator and expansion valve is housed in another cabinet which is placed inside air-conditioning space, These ACs are used for domestic/ commercial air conditioning. The capacities varies form 1 ton to 3 tons.

27.1.16.1.2 **Package Type AC.** A unitary or package air conditioning system uses equipment when all of the basic components (Compressor, condenser, evaporator, A.H.U etc. are assembled in a cabinet in the factory, which is place outside the air condition space, The supply and return air ducts are connected to the package unit, which supplies cool air and extract hot air from air conditioning space. A commonly used package type AC is a roof type unit, which is placed on a roof top, Package type ACs are used in places where air conditioning load is uniform e.g. Libraries, Auditoriums, wedding halls, workshops etc. This is Provision of 15% fresh air in Packaged type AC, which ensures supply of fresh air. The capacity of these units varies from 7.5 to 60 tons.

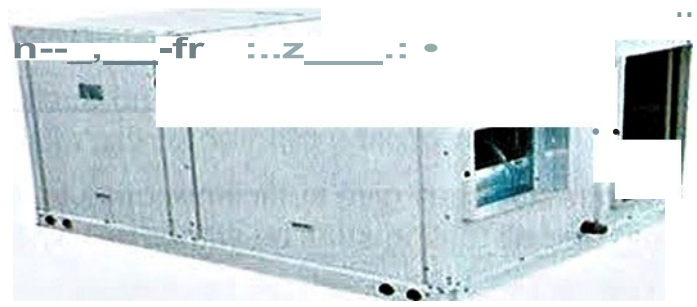


**FIGURE 27-1 : PACKAGE TYPE UNIT**

27.1.16.2.3 **Variable Refrigerant Flow (VRF) or Variable Refrigerant Volume (VRV) System.** A "VRF" "or "VRV" are two different terms for the same type of HVAC technology, based on inverter technology compressors, in the HVAC industry.

(1) The system is capable of adjusting the load as per requirement in various parts of the building, the inverter compressor allows lowering power consumption with partial cooling/heating loads.

(2) Refrigerant is the only coolant material in the system (In contrary to the chilled water system, where refrigerant is used for cooing/heating the water is circulated throughout the whole system.

(3) Several air handling units (indoor units) can be connected on the same refrigerant loop/circuit.

(4) The system has the ability of modular expansion (especially applicable for large projects that can grow in stages).

(5) The ability to adjust power output of the compressor ( Variable speed) rather than merely on-off functionality in traditional systems allows the HVAC system to achieve cost saving in electricity, over the course of a year, In some cases energy saving, is up to 40% of the overall annual energy costs, which is the most valuable advantage of VRF system.

(6) Since supply air flow is varied as per the load , low energy is consumed due to low fan power as compared to full capacity of running of fan in constant volume system i.e. window, split & package type AC.

(7) The capacity of VRF system varies from 8hp (6.6 Tons) to 64 hp (52 Tons) however these system can be connected in series to achieve larger capacities, The VRF system are good for use in office, commercial and educatlonal buildings etc.

(8) A typical VRF system consists of an outdoor unit (Comprising one or multiple compressor) several indoor units refrigerant piping, running form the outdoor to indoors, using Refrigent joints (copper distributors in pipes) and communication wiring. Communication wiring consists of a two wired cable, chained from the outdoor to all indoors, creating an internal closed loop network which is an essential part of any VRF installation.

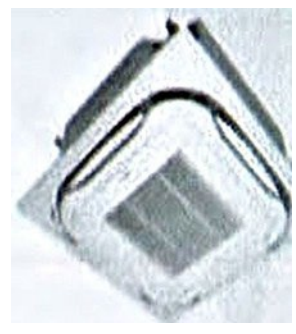


**FIGURE 27-2 : VRF SYSTEM**

**27.1.17. Chillier Systems.** These system are used for large heating of cooling loads and when the clean air requirements are more stringent. The system are ideally suited for Multi-zone high-rise commercial building, Hospital, shopping mall and other industrial application. These are further classified as under:-

27.1.17.1. **Air Cooled Chillier.** In this system, water is cooled first and then air in contact with water is cooled (typical electric power required per ton of cooling/heating = 1.5KWs). These systems do not require cooling tower arrangement. A typical air cooled chillier is shown in Figure 27-3. Air cooled chillier are further classified as under:-

(1) **Scroll Type Air -Cooled Chillier**

| | |
|---|---|
| Capacity | 15 Tons to 80 Ton in modular combination |
| C.O.P | Minimum 3 |

(2) **Screw Type Air -Cooled Chillier**

| | |
|---|---|
| Capacity | 60 Tons to 400 Ton in modular combination |
| C.O.P | Minimum 3.3 |

27.1.17.2. **Water cooled Chillers.** Condenser utilizes water for heat rejection (typical elect power required per ton of cooling/heating = 0.90 KW) requires cooling tower arrangement. A typical water cooled chillier is shown in Figure 27-4 water cooled chillier are further classified as under:-

(1) **Screw Water-Cooled Chillers**

| | |
|---|---|
| Capacity | 75 Tons to 420 Ton |
| C.O.P | Minimum 6 |

(2) **Centrifugal Water Cooled chillers**

| | |
|---|---|
| Capacity | 250 Tons to 1200 Ton |
| C.O.P | Minimum 7 |

**FIGURE 27-3 : AIR COOLED CHILLER**

**FIGURE 27-4: WATER COOLED CHILLER**

## 27.1.18. VRF System

27.1.18.1. The equipment for variable refrigerant volume/flow (VRVNRF) system shall be air-cooled consisting of Outdoor units and multiple Indoor units for cooling the space in summer and heating in winter (whenever Heat pumps are specified).

27.1.18.2. The system shall consist of suitable Outdoor units, Indoor units as requjred, interconnecting refrigerant piping, control cabling and accessories as required.

27.1.18.3. It shall be possible to connect multiple Indoor units on a single refrigerant circuit. The Indoor units on any circuit may be of different type and should allow individual control.

27.1.18.4. The total piping length shall not be more than 300 m.

### 27.1.19. Outdoor Unit of VRF System

27.1.19.1. The Outdoor unit shall be a factory assembled unit housed in a sturdy weather proof casing, constructed form rust-proofed mild steel panels complete with powder coated finish.

27.1.19.2. Each module of Outdoor units shall consist of scroll compressor(s), air-cooled condenser as Heat Exchanger, high efficiency propeller fans with low noise motor, internal refrigerant piping, safety controls, air inlet grills, fan protection grills etc. all enclosed in weather proof housing

27.1.19.3. The Outdoor unit shall have multiple scroll compressors and shall be able to operate even in case of breakdown of one of the compressors. (The smallest capacity unit may have only one compressor).

27.1.19.4. The Outdoor unit shall be suitable for mix and match connection of various types and capacities of Indoor units as per demand.

27.1.19.5. The noise level shall not be more than 62 dB(A) under normal operation, measured horizontally, 1 m away and 1.5 m above ground.

27.1.19.6. The Outdoor unit shall be modular in design and shall allow for side by side installation of multiple Outdoor units, to match the requirement.

27.1.19.7. All the units shall be provided with built-in microprocessor control panel, for automatic operation and capacity control.

27.1.19.8. The units shall be suitable for Refrigerant R-410A.

### 27.1.20. Compressor of VRF System

27.1.20.1. Each unit shall have single/multiple hermetically sealed scroll compressor.

27.1.20.2. The scroll compressor shall consist of two spiral disc, where one is fixed and the other rotate. The disc shall be mounted eccentrically to allow orbital movement. This shall permit compression of refrigerant gas, as it moves up between the eccentric discs.

27.1.20.3. Both the spiral disc out rotor shall be mounted on a common shaft with antifriction bearin_g, suitable for handling both radial and axial thrust.

27.1.20.4. The compressor casing shall be fabricated from mild steel of thickness capable of withstanding the working pressures. The casing shall have built-in oil reservoir with a sump of adequate capacity.

27.1.20.5. The compressor shall be complete with a suitable High efficiency motor hermetically sealed within the compressor housing.

27.1.20.6. The compressor housing shall also have oil reservoir for lubrication and suitable means like an oil pump or pressure differential device shall be provided to lubricate all moving parts.

27.1.20.7. One or more compressor shall be provided with suitable sine wave or equivalent DC Inverter for capacity modulation.

### 27.1.21. Condenser/ Heat Exchanger and Fans of VRF System

27.1.21.1. The condenser shall be air-cooled type, where heat exchanger shall be fabricated from copper tubes, mechanically bonded to aluminium fins to form a cross fin coil. The aluminium fins shall be given anti-corrosion treatment. This treatment shall be suitable for areas of high pollution, moisture and salt laden air.

27.1.21.2. The condenser fans shall be with multi blades of aerofoil design for low noise level, high efficiency and fitted with a high efficiency fan motor.

27.1.21.3. The fan outlet shall be protected by a suitable wire guard on the outside.

27.1.21 A. Suitable devices and heat exchanger means shall be built-in the unit to provide maximum super-cooling of refrigerant to increase system efficiency.

27.1.21.5. The unit shall be complete with safety controls and suitable microprocessor based master control module.

27.1.21.6. The module should be capable of connecting to web or to other devices through common Bacnet or LAN networks.

27.1.21.7. AII the above component shall be housed in a compact mild steel cabinet having air Inlet louvers, safety guard on the condenser fan.

### 27.1.22. Indoor Units (IDU) of VRF System

27.1.22.1. The system shall permit connection of a variety of non ductable or ductable Indoor units on single refrigerant piping circuits, as per description given later.

27.1.22.2. The capacity of the IDU shall vary as per the requirement of the given area.

27.1.22.3. The types of IDU which may be connected may be any of these given below:

(1) High Wall mounted Unit.

(2) Cassette type of different configuration.
(3) Concealed Ceiling suspended units.
(4) Ceiling Suspended High Static Unit.
(5) Ceiling Mounted Exposed unit.
(6) Floor Standing (exposed or concealed) Units.
(7) Ductable Ceiling Mounted High Capacity Units.

### 27.1.23. Common Features of Indoor Units

27.1.23.1. The cooling/heating evaporator coils of the various types of Indoor Units shall be of direct expansion type.

27.1.23.2. The coils shall be fabricated from copper tubes of min 8mm dia. with extended aluminium fins and designed for low velocity.

27.1.23.3. The fins shall be bonded to the tube using hydraulic expansion of tubes ensuring tight bonding between tube and fins for efficient heat transfer.

27.1.23.4. The coils shall be complete with well-designed tube circuiting and liquid distributor.

27.1.23.5. All types of units shall have a built in electronic expansion valve and suitable control units.

27.1.23.6. The control units shall control temperature, fan speed and features specific to each unit such as night mode, set back, etc.

27.1.23.7. Suitable drain pan and drain arrangement shall be part of all IDU's.

27.1.23.8. The control units shall permit control from a corded or a wireless remote controller.

### 27.1.24. High Wall Mounted Units

27.1.24.1. The high wall mounted units will be complete with cross flow fan, vertical DX coil, filters, control units and plastic outer cabinet.

27.1.24.2. The cross flow fan should be of generous dia. and length to deliver the required air quantity at high speed and be very quiet with noise level below 38 dbA.

27.1.24.3. The fan assembly shall be directly mounted on a low noise, high efficiency motor.

27.1.24.4. The air filter shall be electrostatic type to remove dust, polan and other impurities.

27.1.24.5. The outer casing shall be made of high grade plastic, complete with return air grill, motorized supply air louvered opening and suitable metallic back panel for mounting all items.

### 27.1.25. Cassette Type Units

27.1.25.1. The cassette type Indoor Units may be of any of the three configurations, as given below and as may be mentioned in bills of quantity.

(1) Four way or circular air distribution arrangement whichever is specified or is available.
(2) 2•way air distribution arrangement.
(3) 1-way or corner type air distribution arrangement.
(4) The unit shall be complete with turbo fans of multi-blade type, duly statically and dynamically balanced to give the required air flow
(5) The filter shall be of synthetic type to suit the configuration
(6) The unit housing shall have provision for connecting fresh air duct, wherever required.
(7) The unit shall be complete with built-:in high head fail-safe pump with safety cut-outs
(8) Each type of unit shall be supplied complete with air distribution panel whether specified or not.
(9) The panel shall have removable return air core for cleaning air filter and maintaining motor

### 27.1.26. Concealed Ceiling Suspended Unit

27.1.26.1. The concealed units shall be complete with fan assembly, DX evaporator coil, air filter, outer casing and control unit.

27.1.26.2. The fan shall be centrifugal type with housing and mounted directly on the motor shaft.

27.1.26.3. The air filter shall be preferably electrostatic type

27.1.26.4. The outer casing shall be of heavy gauge G.I. sheet duly treated for long life and shall be complete with 25mm deep duly insulated drain pan.

### 27.1.27. Ceiling Suspended High Static Unit

27.1.27.1. The fans shall be selected and designed for highest air static pressure, to allow for at least 5 to 6m of ducting with grills.

### 27.1.28. Ceiling Mounted Exposed Unit

27.1.28.1. The unit shall have a decorative outer casing with built-in supply air and return grills.

27.1.28.2. The casing shall be with anti-corrosive treatment and finished with powder coated paint in attractive finish.

### 27.1.29. Floor Standing Units

27.1.29.1. The floor standing units shall be vertical in design and may be suitable for concealed furred in installation or cabinet type for exposed installation.

27.1.29.2. The fans shall be centrifugal type mounted directly on the motor shaft.

27.1.29.3. The air filter shall be cleanable electrostatic type.

27.1.29.4. The concealed type of vertical unit casing shall be of heavy gauge galvanized sheet with anti-corrosive paint.

27.1.29.5. It should be complete with deep drawn insulated drain pan and shall permit easy access for filter cleaning and maintenance of coil and fan motor.

27.1.29.6. The cabinet type of exposed vertical units shall in addition have a decorative cover with built in supply and return air grills.

### 27.1.30. Ductable Units

27.1.30.1. The ductable indoor units shall be ceiling suspended type, complete with fan assembly, DX coil, air filters, control units and outer casing.

27.1.30.2. The fan shall be centrifugal suction type with fan casing and direct driven motor.

27.1.30.3. The fan shall have a minimum external static pressure of 100 Pa.

27.1.30.4. The air filter shall be cleanable type with maid resistant resin not fixed to an integrally moulded plastic frame. The filter shall be sliding type with frame for ease of insertion and removal.

27.1.30.5. The outer casing shall be of heavy gauge galvanized duly treated for corrosion resistance and finished with powder coated paint. It should have internal insulation to prevent condensation and absorb fan noise.

27.1.30.6. There shall be suitable deep drawn insulated drain pan.

### 27.1.31. Refrigerant Circuit

27.1.31.1. The refrigerant circuit shall include an accumulator, liquid and gas shut off valves and a solenoid valves or pulse with modulation valve.

27.1.31.2. All necessary safety devices shall be provided to ensure the safety operation of the system.

### 27.1.32. Safety Devices

27.1.32.1 The following safety devices shall be part of the outdoor unit; High Pressure Switch, Low Pressure Switch, Fan Motor Safety Thermostat, Over Current Relay, Fusible Plugs, Fuses.

### 27.1.33. Oil Recovery System

27.1.33.1 Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration , piping lengths.

27.1.33.2 The system must be provided with oil balancing circuit to avoid poor lubrications.

### 27.1.34. Package Type Air Conditioner

27.1.34.1 The package unit shall be either air cooled or water cooled. The packaged type AC Plants shall conform to EU standards. The plant shall have a single or multi refrigeration circuit as per design of reputed manufacturers.

### 27.1.35. Cabinet

27.1.35.1 The unit shall be constructed with adequate strength and rigidity to withstand handling, transportation and usages. The unit shall be free from undue noise during operation. The cabinet shall have a frame work of MS angle, of formed MS sheet sections in order to provided structural rigidity. Properly formed close fittings and easily removable minimum 1.25 mm sheet metal panel shall be provided all around the frame work to make a closed and streamlined cabinet. Inside and outside surface shall be finished with polyester epoxy powder coating. The fan and coil section of unit shall be insulated with minimum 25 mm thick resin bonded fibre glass lining on the internal surface covered with minimum 0.50 mm thick aluminium sheet. An insulated cable tray with drain connection shall be provided below fan coil section so as to avoid dripping over the equipment installed in lower portion of the cabinet. A conditioned air outlet from the cabinet shall be provided with suitable flanges for flexible canvass duct connection for conditioned space. A return grill of streamlined design shall be provided in the elevation in front of filter section.

### 27.1.36. Compressor

27.1.36.1 The compressor shall be reciprocating/scroll hermetic or semi hermetic type suitable for R-410/R-134a refrigerant. It shall be fitted with suction and discharge stop valves to facilitate servicing, safety controls, filters, release valves, control valves and standard accessories for efficient operation. The compressor shall be mounted on anti-vibration/vibration resilient material to ensure minimum noise and vibration enduring operation. Each compressor shall be microprocessor controlled with-alarm for operation and protection against high refrigerant pressure, anti-cycle timer, indicating lamp, low_ frequency, single phasing, the compressor shall be designed for 4.4°C suction temperature and 43.3°C discharge temperature.

27.1.36.2 The compressor motor shall be squirrel cage induction motor capable of continuous operation at 415 + 10%, 50 Hz, 3 phase AC supply. The motor shall be suction cooled in case of semi hermetic type units. The starter shall be provided on packaged units itself.

### 27.1.37. Condensers

27.1.37.1 Condenser shall be horizontal shell and tube construction with MS shell and integrally finned copper tube shall be minimum 1 mm before finning. The end covers shall be removable type and suitable provision shall be made in the unit cabinet, enabling easy cleaning of tubes. The compressor shall serve liquid receiver for the refrigerant circuit and shall be complete with following:-

27.1.37.1.1 Inlet and outlet refrigerant connections

27.1.37.1.2 Inlet and outlet water connections

27.1.37.1.3 Relief/Purge valve and connections

27.1.37.1.4 Drain valve, air vent, test cock connection, facility with valves for descaling of tubes.

### 27.1.38. Cooling Coil, Fan Drive

27.1.38.1 Cooling coil shall be three or four row deep as per manufacturers standards, made of copper tubes of minimum 0.5 mm thick and aluminium fins of minimum 0.15 mm thickness mechanically bonded to coil. The fins shall be 4 to 5 per cm of tubes, coil be fitted with equalizing copper distributor to ensure that each coil circuit receives equal amount of refrigerant. The coil shall be designed for face velocity not more than 155 metre per minute. The coil shall be thoroughly evacuated, dried and pressure tested to 300 psi (21Kg/sqcm). The copper tubes for refrigerant shall include thermostatic expansion valve and suction gas strainer. The insulation for suction line shall be as per manufacturer's standards.

27.1.38.2 The fan shall be statically and dynamically balanced single/double inlet centrifugal type, designed for quite operation. The fan wheel shall be constructed of aluminium or galvanized steel. Self oiling bearings easily accessible for maintenance with thrust collar shall be provided. The bearing shall be lift lubricated sealed type mounted on vibration absorbing resilient supports. The fan shall be belt driven through adjustable pulley permitting air quantity to be varied by adjusting fan speed. Suitable fan belt tension adjusting arrangement shall be provided. The fan motor shall be mounted within cabinet. This shall be of TEFC enclosures, squirrel cage induction motor of suitable HP for the relevant class of duty. The same shall be located with proper alignment with fan pulley for the belt drive DOL starter upto 5 HP motor with single phase preventer shall be provided. The cleanable aluminium wire mesh/synthetic filter at least 25 mm thick shall be provided swung fit to prevent air bypass. The face velocity across filters shall not exceed 100 metre per minute.

### 27.1.39. Interlocking

27.1.39.1 The compressor motor shall be interlocked with air flow switch in the evaporator fan discharge, differential pressure switch in the condenser water line, condenser water pump and cooling tower fan motor.

### 27.1.40. Pressure Gauges

27.1.40.1 Pressure gauge shall not be less than 100 mm dia dial type and of appropriate range and be complete with shut off gauge cocks etc, duly calibrated before installation

27.1.40.2 Pressure gauges shall have micrometre type zero adjuster.

27.1.40.3 Scale of gauge shall be white with black letters (printed).

27.1.40.4 Pressure gauges shall be as per EU Standards.

27.1.40.5 Scale shall be so selected that normal process pressure is approximately 75% of full scale reading.

27.1.40.6 Pressure gauges shall be provided at the following location and as indicated on the drawings:-

(1) Supply and return of condensers.
(2) Suction and discharge of pumps.
(3) Inlet and outlet of heat exchangers (Cooling coils & heating coils).

### 27.1.41. Temperature Gauges

27.1.41.1 Temperature gauges shall be 100 mm dia dial type of appropriate range duly calibrated before installation

27.1.41.2 Temperature gauges shall have 100 mm dia, dial with die cast minimum, stove enamel black finish case, aluminium screwed ring and shatter proof glass.

27.1.41.3 Accuracy shall be +1.0% of full scale or better.

27.1.41.4 Minimum over range protection shall be 25% of full scale range.

27.1.41.5 Dial type temperature gauges shall be provided at supply and return of chillers, condensers, cooling coils, hot water generator and coils.

### 27.1.42. Balancing, Testing and Commissioning

27.1.42.1 Balancing of all air systems and all tests shall be carried out by the contractor in accordance with the specifications, Pakistan Standard Specifications and recommendations of the American Society of Heating, Refrigerating and Air Conditioning Engineers (USA}. Test results for summer, winter and monsoon shall be tabulated in approved manner and four copies shall be submitted to the Accepting Officer for his scrutiny. Four copies of the certified manufacturer's performance curves for each piece of equipment shall be submitted along with the test results. The contractor shall also provide to the Engineer-in-Charge/Accepting Officer four copies of record of all safety and automatic control settings for the entire installation

27.1.42.2 The contractor shall pay for and arrange, without any extra cost to the Govt, all necessary balancing and testing equipment, instructions, materials, accessories, fuel and the requisite labour. Electricity and water supply shall be made available by the department free of cost. Any defected in the course of testing shall be rectified by the contractor entirely at his own cost to the satisfaction of the Engineer-in-Charge/Accepting Officer. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Accepting Officer. All tests shall be carried out in the presence of the representative of accepting officer. VRFNRV, package units, all types chillers i.e water cooled chiller, air cooled chillers, AHU and FCU's etc 100% European/USA make and eurovenUAHRI certified in accordance with latest edition of ANSI / AHRI standard 550/590, EN14511 and 14825.

**Detail of Thermal Insulation**

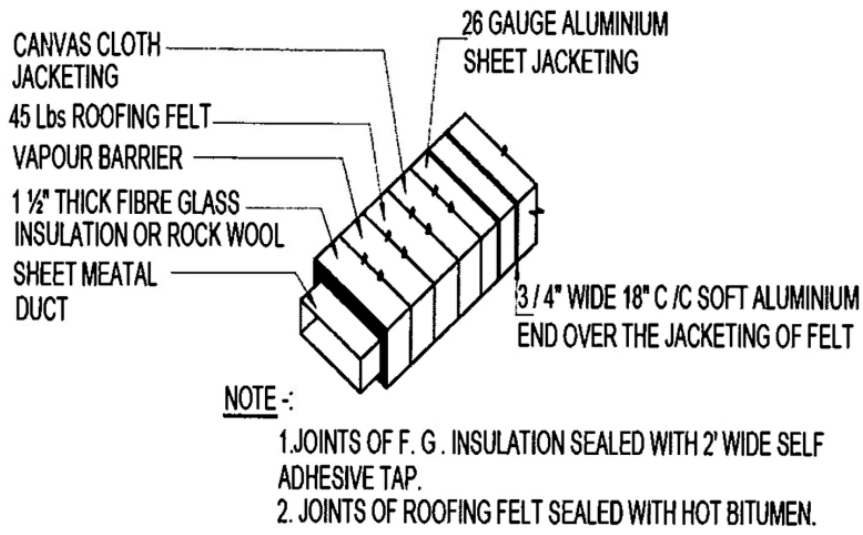

CANVAS CLOTH JACKETING
26 GAUGE ALUMINIUM SHEET JACKETING
45 Lbs ROOFING FELT
VAPOUR BARRIER
1 ½" THICK FIBRE GLASS INSULATION OR ROCK WOOL
SHEET MEATAL DUCT
3 / 4" WIDE 18" C /C SOFT ALUMINIUM END OVER THE JACKETING OF FELT
NOTE -:
1.JOINTS OF F. G . INSULATION SEALED WITH 2' WIDE SELF ADHESIVE TAP.
2. JOINTS OF ROOFING FELT SEALED WITH HOT BITUMEN.

**FIGURE 27-5 : AIR DUCT (OUTSIDE BUILDING)**

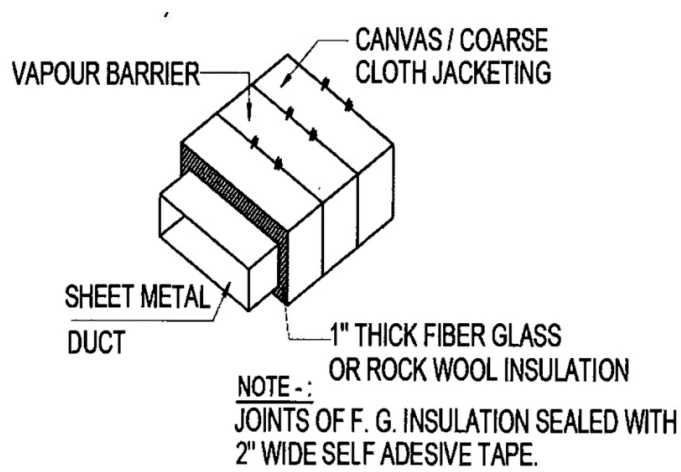

VAPOUR BARRIER
CANVAS / COARSE CLOTH JACKETING
SHEET METAL DUCT
1" THICK FIBER GLASS OR ROCK WOOL INSULATION
NOTE - :
JOINTS OF F. G. INSULATION SEALED WITH 2" WIDE SELF ADESIVE TAPE.

**FIGURE 27-6 : AIR DUCT (INSIDE BUILDING)**

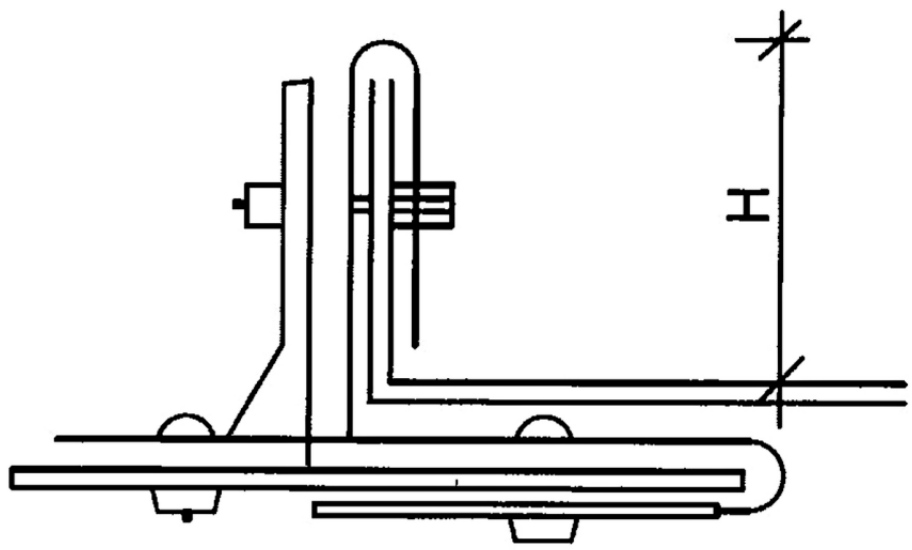



**FIGURE 27-7: REINFORCED POCKET LOCK**

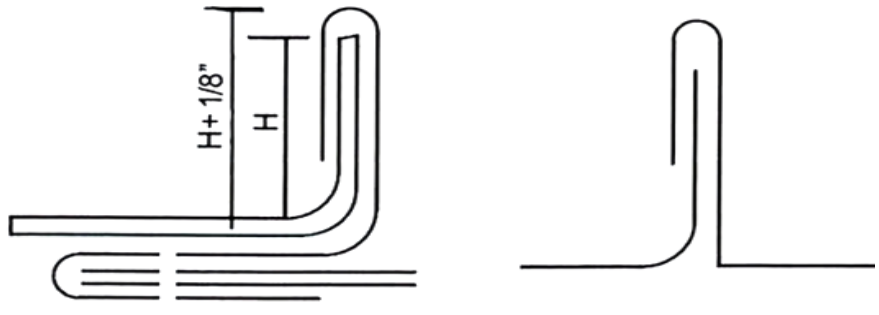



**FIGURE 27-8 : POCKET STANDING SEAM**

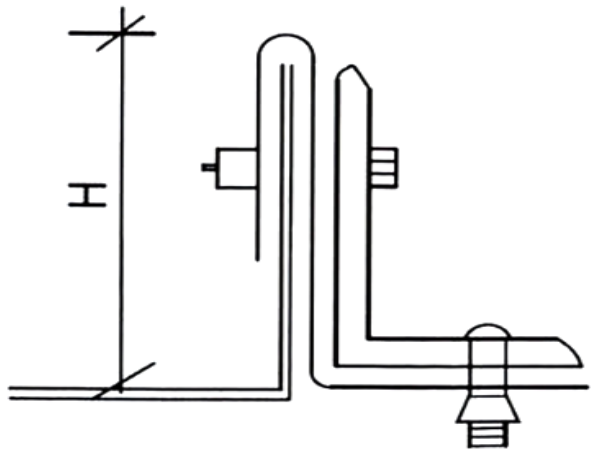



**FIGURE 27-9 : REINFORCED STANDING SEAM**

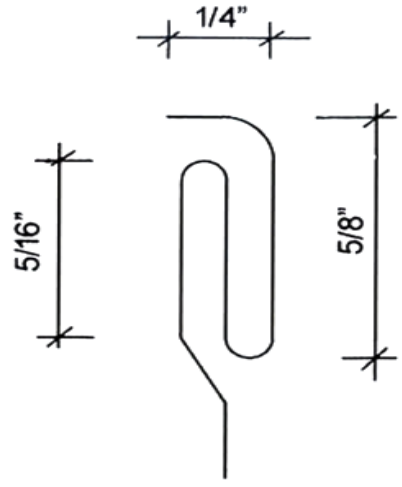



**FIGURE 27-10 : PITTS BRUG LOCK**

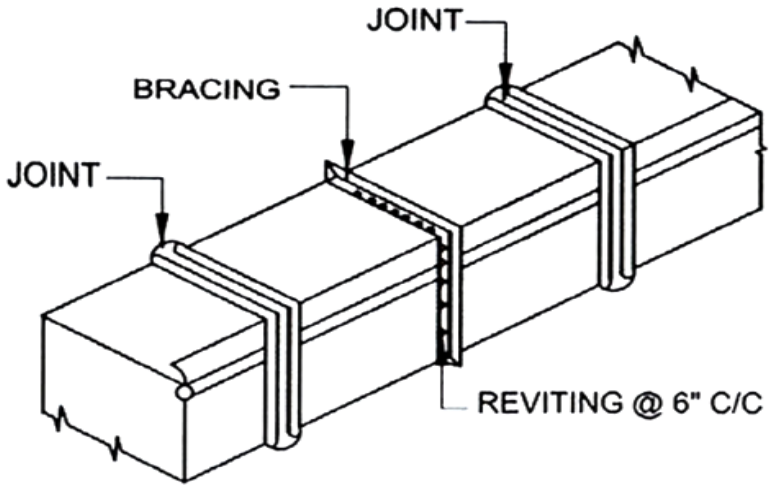



FIGURE 27-11 : BRACING

## SUB SECTION 27-2

## PASSENGER/ CARGO ELEVATORS

**27.2.1. Introduction to lifts.** Passenger/Cargo Lifts are now commonly used in multi storey/high-rise buildings. Lift has a completely enclosed lift car that travel vertically with in a specially prepared lift shaft, passengers are transported between floors at reasonably speeds and control system are often designed to give the most economical distribution of passengers throughout the building.

**27.2.2. Types of Lifts**

(1) Passenger Lift traction type
(2) MRL ( Machine Room Less ) type
(3) Machine Room type
(4) Cargo/ Commercial Lift
(5) Hospital Bed Lift

**27.2.3. Elevator Parameters**

(1) Building type
(2) Car capacity
(3) Rise
(4) Speed

**27.2.4. Main Parts**

(1) Elevator car
(2) Machine beam
(3) Machine room
(4) Pit
(5) Shaft
(6) Counterweight or balance-weight
(7) Traction drive
(8) Travelling cable
(9) Top clearance
(10) Guide rails

**27.2.5. Requirements**

27.2.5.1 **Good System.** Quiet equipment, smooth journey, good condition and safe at every moment.

27.2.5.2 **Waiting time.** Minimum waiting time at any level.

27.2.5.3 **Aesthetics.** Button panel clear and easily reached at appropriate level. Complete instruction. Decorative lighting and comfortable.

27.2.5.4 **Movement of door.** Door movement is quiet and fast are the selection factors.

27.2.5.5 **Utility.** The function must be identified whether for commercial, office or hospital.

27.2.5.6 **Capacity of lift.** Depends on the access building pattern and building size.

27.2.5.7 **Speed.** Depends on the number of stops and number of users.

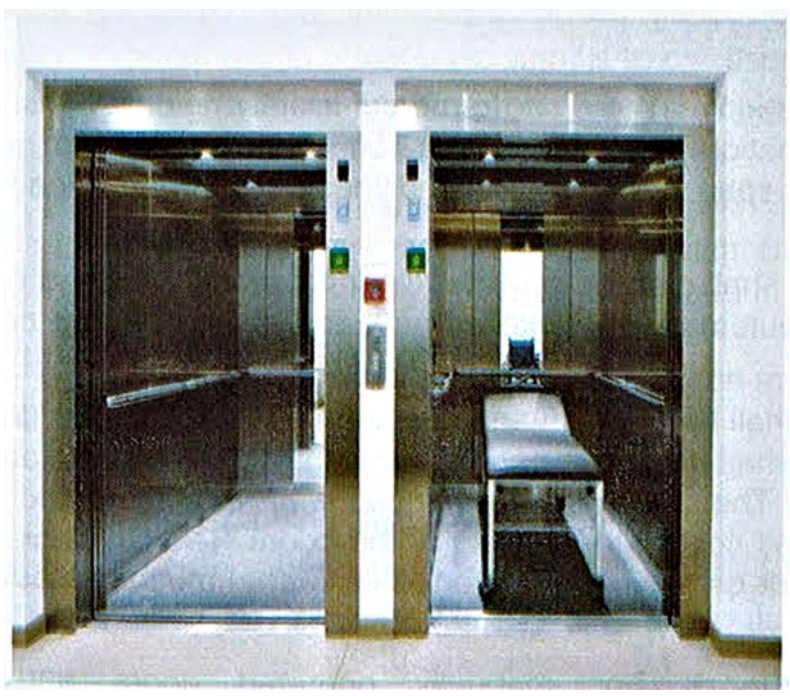


**FIGURE 27-12 : BED LIFT**

**FIGURE 27-13: PASSENGER LIFT**

**27.2.6. Standard Specifications.** Specifications cover the requirement of design, manufacturing, assembling, testing, delivery, installations & commissioning of Passenger and Cargo lift with Machine Room and Machine Room Less (MRL) requirement.

**27.2.7. Material.** The following components & accessories forming a part of the elevator installation shall be supplied and installed. All the items shall conform to the requirements of the International Standard EN 81-20/50 EN 81-58 (E120) and specification.

(1) Guide rails of steel with working surfaces machined for the car and counter weight.
(2) Spring buffers located in the lift pit.
(3) Steel car frame with replaceable guide shoes.
(4) Lift cars fitted with all interiors such as, false ceiling, flooring, ventilation fan, lights, operator's panel, floor indicator, lift mirror, handrails, emergency stop facility etc.
(5) Motor operated sliding, center opening car doors wherever applicable.
(6) Counter weight with guide shoes.
(7) Speed Governors.
(8) Suspension Ropes.
(9) Sheaves & Pulleys.
(10) Lift machines.
(11) Controllers and wiring materials.
(12) Terminal stopping and final limit switches.
(13) Leveling devices.
(14) Lifting beam for machines.
(15) Any other accessories as required.

**27.2.8. Machine Room (If Applicable).** The load carrying capacity of the floor shall be as per recommendations of lift manufacturers. Suitable lifting beams below the machine room shall be provided for lifting any heavy object as per requirement of **the** lift manufacturer. Provision for pulley for lifting of heavy items/lift machinery is required which will facilitate inspection and repair. The machine room shall be properly ventilated.

**27.2.9. Counter Weight.** The counterweight shall be of metal and it shall be in the form of multiple sections. It shall be contained and secured within a steel frame and shall be equal to the weight of the complete car plus approx. 50% of the rated load. At least, four guide shoes, capable of being easily renewed or having renewable linings shall be provided on the counterweight.

**27.2.10. Suspension Ropes.** Cars and counterweights shall be suspended from round stand steel wire ropes of best quality having a tensile strength not less than 12.5 tons /$cm^2$. The size and number shall be in accordance with standard Code of practice/specifications. Lubrications between the stands shall be achieved by providing impregnated hemp core. The nominal diameter of the ropes shall be at least 8 mm.

**27.2.11. Compensation Ropes.** For travels over 40 m or rated speed of the lift exceeds 2.5mps, the proven of compensation ropes with tensioning pulleys shall be considered. For speeds of 2.5mps or below, quite operating chains or similar devices shall be used as the means of compensation. For speeds above 3.5mps, an anti-rebound arrangement of idler tension pulley shall be provided to prevent the counterweight jumping with the application of the car safety gear.

**27.2.12. Car Construction.** The lift car construction shall be in conformity with Code of Practices / specifications and Electricity Rules.

27.2.12.1 **Car Frame.** The lift car body shall be carried in a steel car frame sufficiently rigid to withstand the operation of the safety-gear without permanent deformation of the car frame. The deflection of the members carrying the platform shall not exceed 1/1000 of their span under static conditions with threated load evenly distributed over the platform.

27.2.12.2 **Emergency Lighting Battery.** The lift car shall also be provided with emergency lighting operated by a rechargeable battery supply. The lighting shall be automatically switched on in the event of failure or normal power upply to the lift.

27.2.12.3 **Car Doors.** The doors for passenger lifts shall be of metal and the internal face of the car door shall be suitably lined as the same in the lift car. The doors shall be in two panels and centre opening with automatic power opening and closing unless otherwise specified. The car shall be equipped with an electric door sensor which can defect an obstruction at the car entrances and control the closing of the doors. The car door shall be provided with an electric switch which will prevent the lift car from being started or kept in motion unless all car doors are closed.

**27.2.13. Door-Open Alarm for Manually Operated Doors.** For manually operated doors and where assisted doors, a "door open" alarm shall be provided in the car to draw attention to a car or landing door which has been left open for an adjustable period up to 10 minutes.

**27.2.14. Landing Doors.** The car 1,:t.rance shall be provir J wItn d Cd1 Joor, which shall extend to the full height and width of the car opening. The opening for the land'ny doors shall not be wider than that of the lift car. The top track of the door shall not obstruct the car entrance All landing openings in lift well enclosures shall be protected by doors which shall extend to the full height and width of the landing opening.

**27.2.15. Safety Gear.** The lift shall be provided with safety gears capable of operating only in the downward direction and capable of stopping a fully laden car, at the tripping speed of the o·,er-speed governor. even if the suspension devices break, by gripping the guides and holding the car there.

**27.2.16. Over-Speed Governor.** The car safety shall be operated by speed governor located overhead and driven by governor rope suitably connected to the car and mounted on its *OVvC'* pulley. Over-speed governor shall operate the safety gear at a speed at least equal to 115% of the rated speerl. For rated speeds upto 1mps maximum governor tripping speed shall be either 140% of the rated speed or 0.88mps, whichever is higher. For rated speed exceeding I mps, maximum governor speed shall be 115% of :he rnted peed plus 0.25mps. The means for adjusting the over-speed governor shall be sealed after setting the trir.,oi: ,g Rpeed.

**27.2.17. Governor Ropes.** The governor ropes shall not be less than 6 mm ii, diameter and shall be of flexible wire rope. The rope shall be tensioned by a tensioning pulley and the pulley (or its tensioning weight) shall be guided. The breakage or slackening of the governor rope shall cause the motor t0 stop by means of an electrical safety device. The device shall be of bi-stable type requiring manua' reset.

**27.2.18. Overload Device.** The lift shall be provided with an overloc1d device which shall operat when the load in the car is 10% or more in excess of the rated load of thp,,•.The overload device, when in operation, shall

(1) Prevent any movement of the car.

(2) Prevent the closing of any power operated door whether fitted to the car or to the landing at which the car is resting, and

(3) Give audible and visible signals inside the car.

27.2.18.1 The lift shall resume normal operation automatically on removal of the excessive load. The overload device shall be inoperative while the lift car is in motion.

**27.2.19. Full Load Device.** The lift (other than a service lift) shall be provided with a full load device having an adjustable setting range from 80% to 100% of the rated load and when operated, it shall by-pass all landing calls. When the load in the car is reduced, the car shall stop for landing calls as normal.

**27.2.20. Emergency Alarm Device.** An emergency alarm push button together with a buzzer (c,, J.n alarm bell) shall be provided in the lift car and connected to the machine room and the main entrance lift lobby and backed up by an emergency supply. The pattern of lift alarms shall be distinguishable from that of fire alarms.

**27.2.21. Intercom System** connecting the lift car and the machine room/guard room (if manned) shall be provided.

**27.2.22. Emergency Exit.** The lift car shall be provided with an emergency exit in the roof of minimum size 500 mm x 350 mm or 400 mm in diameter. Panels for emergency exits shal!:-

(1) Be clear of any apparatus mounted above the roof of the lift car

(2) Be capable of being opened, re-closed and re-locked without a key

(3) Be provided with an electric safety device which will prevent operation of the lift when the panel is not locked, operate the buzzers (or alarm bells) and also switch off the car ventilation fan.

**27.2.23. Control and Indication in Car.** The lift car shall have a control faceplate made of stainless steel comprising of following:-

(1) Call buttons with acceptable signals to correspond with the landing served

(2) An alarm push button with protection from being operated accidently

(3) "Door open" and "Door close" push buttons

(4) Audible and visible signals in connection with the overload device

(5) Light switch, alarm reset switch, fan switch and cleaner's "Stop-switch" keeping the car door open in the form of key switches or housed in a recessed metal box with hinged or sliding lid which will be key-locked.

(6) Provision for placing of Intercom set shall be available into the car.panel.

·(7) Load Plate And Warning Notice

(8) Car And Landing Door

(9) Terminal Stopping Switches

(10) Lift Announcement

(11) **Electrical Supply Specifications**

| | | |
|---|---|---|
| (a) | System Nominal voltage | 415 V |
| (b) | Voltage variation limits | +/- 5% |
| (c) | No of phases | 3 |
| (d) | Frequency | 50 Hz |
| (e) | Frequency variation limits: | +3% or-5% |
| (f) | Fault level | Not exceeding 50KA at 415 V |
| (g) | Neutral earthing on LV side | Solidly earthed |

### 27.2.24. Installations

(1) The lift shall be installed as per international standard EN 81-58 (E120). Wiring and earthing shall be extended from the electrical shaft & lift shaft as per requirement. Power cable & earthing point will be made available at power panel at one location for each lift.

(2) All openings at the various landing shall be temporarily guarded during installation.

(3) All safety procedures associated with lifting of heavy equipment, operation of electrical tools & earthing should be strictly complied with.

(4) Al electrical wiring shall have flame resisting moisture proof insulation and will be run in heavy gauge metal conduit / casing.

(5) The trailing cable between the car and lift well will be multicore type designed for lift services and will have flame resisting moisture proof covering.

(6) All wiring and earthing etc. shall conform to Electricity rules and regulations.

(7) The supply and erection of lift shall conform to the latest lift act in force and modern lift practice in all respect.

### 27.2.25. Testing and Commissioning

(1) All equipment included in contractor's scope of supply shall be pre-inspected/tested at manufacturers works, before delivery and necessary test certificate shall be submitted to employer/consultant.

(2) The contractor shall carry out all performance tests after installation, in the presence of the Client/ Consultants, as per specification. The contractor shall bear all expenses for such test.

(3) The contractor shall be responsible for executing the contract as per Electricity Rules and Regulations of supply authorities and the Rules of the local Electrical Inspector.

(4) Any changes/modifications pointed out by the authorities shall be carried out at no extra cost.

(5) Each elevator shall be tested at site as per latest international standard, the test shall include:

(a) Operational test with functional check on safety devices

(b) Speed of operation at rated load

(c) Levelling accuracy

(d) HV Test

## SUB SECTIN 27-3

## FIRE EXTINGUISHING AND SUPRESSION SYSTEMS

**27.3.1.** An addressable fire alarm system is made up of series of fire detectors and devices that are connected back to a central control panel with address system, each devices has an own address or location, enabling the exact detector that was triggered to be quickly identified this system is ideal for large building.

### 27.3.2. Advantages of Fire Alarm System

27.3.2.1 Quickly determine the exact location of fire.

27.3.2.2 Specific action can be programmed by the user.

27.3.2.3 Reduced likelihood and better handling of false alarms.

27.3.2.4 Lower ongoing cost because a device goes into trouble (i.e. needs cleaning, repair or replacement) will indicate exact location of device needing service.

27.3.2.5 **Online capabilities.** New intelligent panels have capability to provide detail online notification of alarm/trouble/supervisory events.

27.3.2.6 System consist of following devises/items:-

(1) ' Addressable control panel
(2) Detector (Heat, Smoke, Multi, Natural Gas etc.)
(3) Input and output module
(4) Manual call point, sounders
(5) Smoke damper modules
(6) Fire fighter telephone control
(7) Announce alarm matrix panel
(8) Wirings

### 27.3.3. Fire Alarm System

27.3.3.1 **Standards & Specifications**

27.3.3.1.1 **Manufacturers Codes and Standards.** The System shall meet the following design Standards as required by the law of the country. If no specific local laws are available National Fire Protection Association (NFPA) - USA shall be followed National Fire Alarm Code

(1) NFPA No 268 Smoke Detectors for Fire Protective Signalling Systems
(2) NFPA No.864 Control unit For Fire Protective Signalling Systems
(3) NFPA No.268A Smoke Detectors for Duct Applications
(4) NFPA No.521 Heat Detectors for Fire Protective Signalling Systems
(5) NFPA No.464 Audible Signalling Appliances
(6) NFPA No. 38 Manually Actuated Signalling Boxes
(7) NFPA No. 346 Water flow Indicators for Fire Protective Signalling Systems
(8) NFPA No. 1971 Visual Notification Appliances
(9) BS5839 & Local Fire Code

27.3.3.1.2. **National Fire Protection Association (NFPA) Codes**

| | | |
|---|---|---|
| (1) | NFPA 13 | Sprinkler System |
| (2) | NFPA 15 | Water Spray Fixed System |
| (3) | NFPA 16 | Deluge, Foam-Water and Foam-Water Spray Sys |
| (4) | NFPA 70 | National Electric Code (NEC) |
| (5) | NFPA 70 | Article 300 - Wiring Methods |
| (6) | NFPA 70 | Article 760 - Fire Protective Signaling System |
| (7) | NFPA 72 | National Fire Alarm Code |
| (8) | NFPA 101 | Life Safety Code |
| (9) | NFPA 11O | Emergency Standby Power System |
| (10) | NFPA 2001 | Standard for Clean Agent Fire Suppression |

27.3.3.1.3. **VdS Laboratories/ Standards**

| | | |
|---|---|---|
| (1) | VdS CEA 4001 | Sprinkler Systems, Planning and Installation |
| (2) | VdS 2465en | Transmission protocol for Alarm Systems (AS) |
| (3) | VdS 2095en | Automatic Fire Detection and Fire Alarm Systems, Planning and Installation |

(4) VdS 2135en Graphic Symbols for Alarm Systems
(5) VdS 2380en Fire Extinguishing Systems using non-liquified Inert Gases
(6) VdS 2381en Fire Extinguishing Systems using Halocarbon Gases
(7) VdS 2893en Maintenance of operational readiness of fire extinguishing systems with gaseous extinguishing agents, Leaflet

27.3.3.1.4 **Underwriter Laboratories (UL) Standards**

(1) UL Standard 217 Smoke Detectors, Single and Multiple Station
(2) UL Standard 228 Door Closer - Holders for Fire Protective Signaling System
(3) UL Standard 268 Smoke Detectors for Fire Protective Signaling Systems.
(4) UL Standard 268A Smoke Detectors for Duct Applications.
(5) UL Standard 521 Heat Detectors for Fire Protective Signaling Systems.
(6) UL Standard 464 Audible Signaling Appliances.
(7) UL Standard 38 Manually Activated Signaling Boxes.
(8) UL Standard 346 Water Flow Indicators for Fire Protective Signaling Systems.
(9) UL Standard 1481 Power Supplies for Fire Protective Signaling Systems.
(10) UL Standard 1638 Visual Signaling Appliances.
(11) UL Standard 1971 Visual Signaling Appliances
(12) UL Standard 864 Fire alarm / suppression system

**27.3.4. Installation shall be made in accordance with the following standards:**

(1) National Fire Protection Association Standard 72
(2) VdS 2095, Automatic Fire Detection and Fire Alarm Systems, Planning and Il1stallation
(3) Local Protective Signaling Systems
(4) Auxiliary Protective Signaling System
(5) Remote Station Protective Signaling Systems
(6) Local Code and Authorities Having Jurisdiction (AHJ)

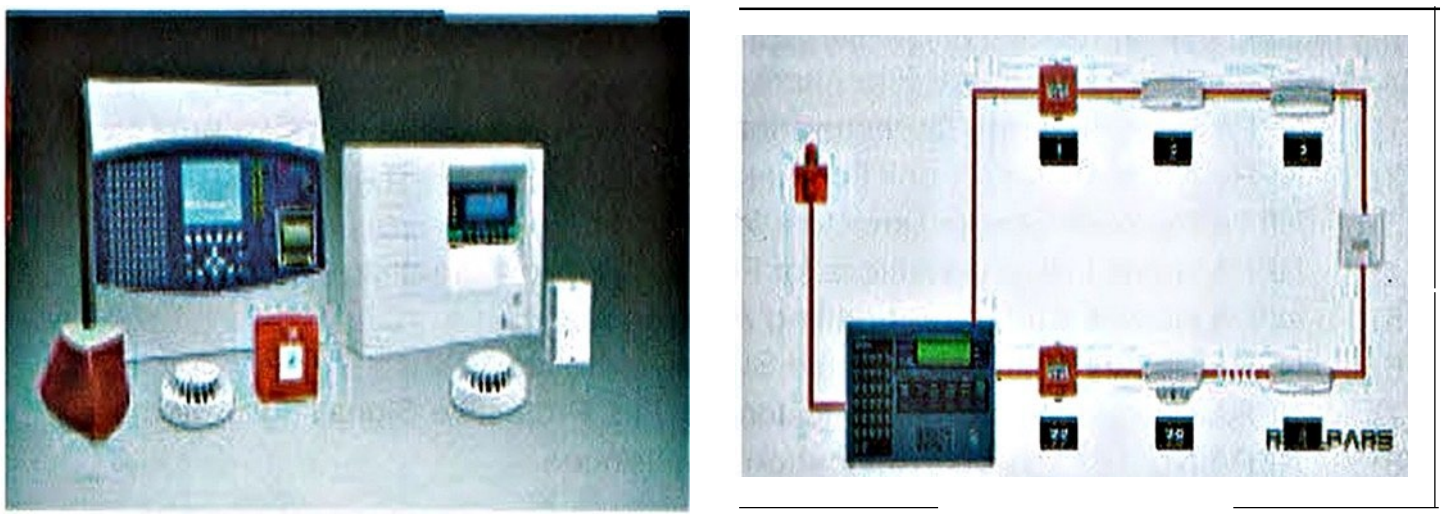


**FIGURE 27-14: FIRE ALARM SYSTEM**

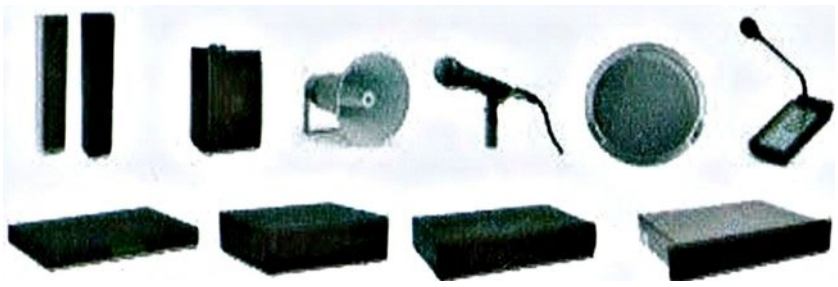
## SUB SECTION 27-4

## PUBLIC ADDRESS SYSTEM

**27.4.1.** A public address system (PA system) is an electronic system comprising microphone, amplifiers, loudspeakers and related equipment. It increases the apparent volume (loudness) of human *voice,* musical instrument, or other acoustic sound source or recorded sound or music. PA system are used in public venue, like auditorium, Mosques, Schools, Hospitals and Stadiums.

**27.4.2. System Contents**

(1) Main racks
(2) Power amplifiers
(3) Graphic equalizer 2/3 *Octave*
(4) Ambient noise sensor system
(5) Matrix Controller System
(6) Ceiling loud speakers
(7) Microphones and microphone pre - amplifier (1,8,16 zones)
(8) Column loud speakers
(9) Horn loud speakers
(10) AM/FM tuner of digital type complete with antenna & Cables
(11) Cassette recorder/player (dual configuration)



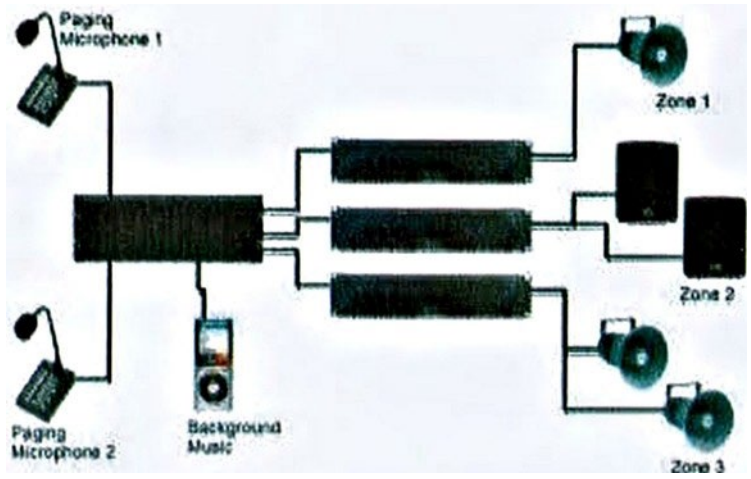



**FIGURE 27-15: PUBLIC ADDRESS SYSTEM**

**27.4.3. Regulation and Standard**

27.4.3.1 The supply shall conformed to requirements of referenced industry standards, applicable sections

27.4.3.2 The supply shall be compliant with Local Requirements, applicable local regulations and code requirements of authorities having jurisdiction.

27.4.3.3 These shall have precedence *over* other codes and standards indicated, unless otherwise approved by Engineer, in writing

27.4.3.4 Standards to be used in the IEC or other equal and approved codes, taking into account that network cables with fitted accessories and connector, wiring and loudspeakers have to be of fire rated type in accordance with all NFPA requirements codes (NFPA72 and extensions).

27.4.3.5 System components, parts and installation s'hall comply with the corresponding recommendations of the Electric Industries (EIA), and the International Electro-technical Commission (IEC)

27.4.3.6 ISO/IEC 11801: latest edition regarding Information technology and generic cabling for customer premise.

27.4.3.7 EIA/TIA 568, Commercial Building for Telecommunication Wiring Standard.

27.4.3.8 EIA/TIA 569, Commercial Building for Telecommunication Pathways and spaces.

27.4.3.9 EIA/TIA 606 for Telecommunications Infrastructure, this docum nt provides the use.r with guidelines and choices of classes of administration for maintaining telecommunications infrastructure.

27.4.3.10 EIA/TIA 607 Commercial Building Grounding (Earthling) and Bonding.

27.4.3.11 Requirements for Telecommunications (ANSI/J-STD-607-A-2002)

27.4.3.12 IEC 60754-1 & 2 Test on gases *evolved* during combustion of materials from cables and Test on gases *evolved* during combustion of electric cable.

27.4.3.13 IEC 61034-1 & 2 test and Measurement of smoke density of cables burning under defined conditions.

27.4.3.14 IEC 60331 part 11 & 12, Test for electric cables under fire conditions.

27.4.3.15 IEC 60332 Tests on electric cables under fire conditions.

27.4.3.16 IEC 60364-1 Electric installations of buildings, Fundamental principles assessment of general characteristics, definitions.

27.4.3.17 The system design shall be based on the following criteria:-

(1) Average sound pressure level: 80 to 85 dB(A) with respective amplifiers set at 60% of maximum volumes.

(2) Ineligibility index: STI: better than 0.50 in public areas at 30% occupancy.

(3) Sound diffusion level : 15 to 20 dB (A) above ambient noise level.

(4) Total harmonic distortion.

(5) Electronic : less than 1% at specified output level.

(6) Acoustic: less than 3% at specified output level.

(7) Frequency response: +/- 3 dB over 100 Hz to 18 kHz.

(8) Uniformity of coverage: + /- 3 dB (0.25, 0.5, 1, 2 and 4 kHz.

## SUB SECTION 27-5

## EQT CRANE

**27.5.1.** This section covers the EOT Cranes single, double girder and explosion proof Cranes. Indoor Electric overhead travelling crane or EOT crane is one of the most common types of overhead crane or called bridge crane, which consist of parallel runway with a travelling bridge spanning the gap. EOT crane are operated by electricity generally there is an operator cabin or a control pendant along with the EOT crane. It is used in the warehouse and workshops. Unloading/relocating heavy load, it is equipped with mechanical means to realize the traveling not only in both direction but also can raise or lower the heavy load easily.

**27.5.2. Standards & Specifications**

**27.5.2.1. Reference Codes and Standards.** The crane supplied shall comply with the latest applicable Pakistan/International standards. Other national standards are acceptable if they are established to be equal or superior to the referred standards. Some of the applicable codes are listed below:

(1) CMAA: Code of practice for electric Overhead travelling cranes and gantry cranes other than steel work cranes.
(2) CMAA: Design, erection and testing (structural portion) of cranes and hoists- Code of practice
(3) ISO6336: Gears-Spur and Helical Gears- Calculation of Load Capacity.
(4) CMAA: Crane rail section.
(5) CMAA: Point hooks with shank upto 160 Tonne.
(6) CMAA: Carbon steel billets, blooms, slab and bar for forgings.
(7) CMAA: Steel Wire Ropes for General Engineering Purposes.
(8) IEEE: Three phase induction motors.
(9) CMAA: Specification for structural steel fabrication.
(10) Applicable portions of American Standard Safety Code for Cranes, Derricks and Hoists.
(11) 1.11 Electrical Overhead Cranes Institute (EOCI) specifications and general information for standard industrial service electric overhead travelling crane.
(12) Standards of National Electrical Manufacturers Association (NEMA).
(13) American Standards Association (ASA).
(14) American Society of Testing Materials (ASTM).

**27.5.3. Types of EQT Crane**

27.5.3.1 **Single girder EOT Crane.** It is used for lighter load. It has single girder, which is easy to installed and require less maintenance

27.5.3.2 **Double girder EQT Crane.** It is used for heavy load. It has double girder.

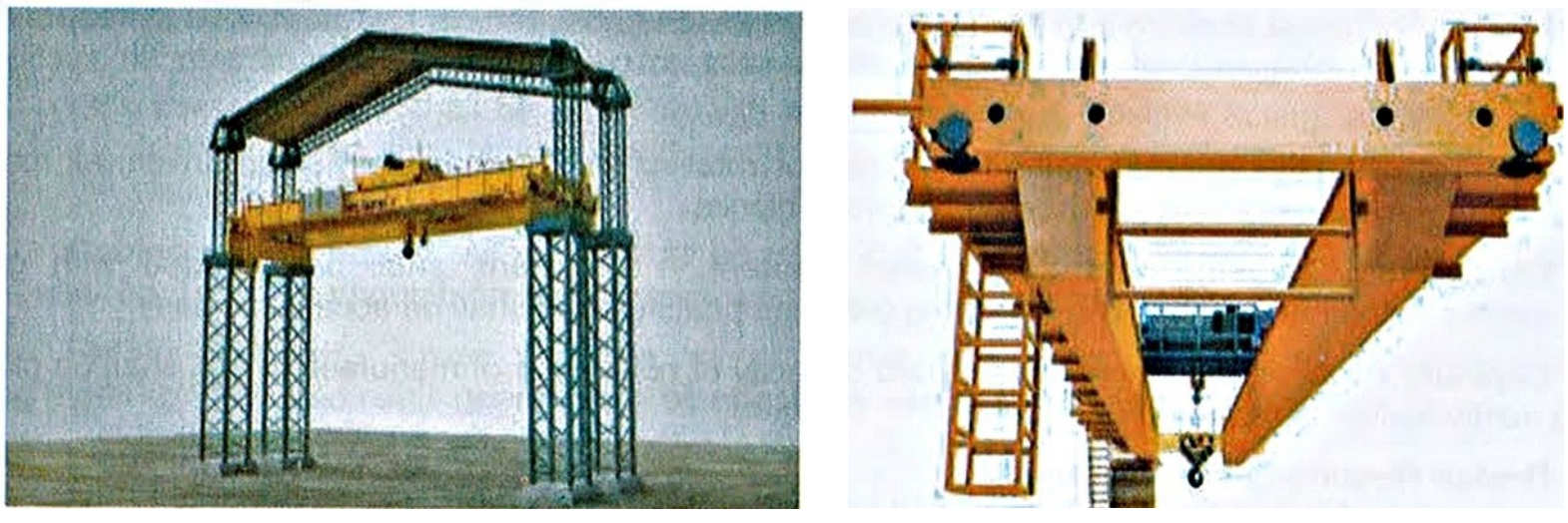


**FIGURE 27-16: EQT CRANE**

**25.5.4. Parts of EQT Crane**

(1) Bridge
(2) End Carriage
(3) Wheel of the Bridge
(4) Crab ( without auxiliary hoist)
(5) Hoisting machinery set
(6) Wheel of Crab
(7) Bottom block (without auxiliary Hoist )

(8) Lighting hook
(9) Rail on gantry girder for Crane movement
(10) Rail on the bridge for crab movement
(11) Operator cabin/central pendant

**27.5.5. Crane Bridges and Trolleys.** The end trucks of the bridge and trolley shall be provided with suitable jacking pads. Wheel mountings shall include safety lugs. The end carriage and girder joint shall be designed to prevent skewness. Bridge and Trolley shall be provided with suitable platforms. The platforms shall be surrounded by suitable hand railings to facilitate easy access and maintenance of equipment placed on the trolley and bridge. The mechanical end stoppers (spring buffers) shall be provided for effectively arresting the motion of bridge and trolley. They should be fitted rigidly on the gantry beams for the crane bridge and on the bridge girder for the trolley at all the four corners. The mechanical wheel stoppers are also desired for LT & CT for additional safety. Girder and end-carriages shall be epoxy painted from inside before its closing.

**27.5.6. Gears, Shafts and Axles.** In order to ensure smooth operation and long life of gear train, all gear transmission shall be achieved from accurately formed machine-cut helical gears at each stage. All shaft sand axles shall be turned from solid rolled and forged steel bars. All axles shall be held rigidly in position by arresting plates and shall be designed for easy removal.

**27.5.7. Wheels and Rails.** Driving/driven wheels of LT and CT shall be of double flange cylindrical or tapered (conical) treads type. The wheels and wheel assembly shall be mounted in such a manner as to facilitate ease in removal and replacement. The rails shall be fixed on the runway and bridge. The wheels shall be ultrasonic tested.

**27.5.8. Hooks and Hook blocks.** The hook shall be compact in nature. The hook block shall be designed to lift the rated load without twisting. The hook shall be capable of swivelling and designed to turn easily on antifriction roller thrust bearings. The hook shall be provided with suitable. Locking arrangement for locking the swiveling action at each rotation as and when required.

**27.5.9. Hoist Rope.** Hoist rope shall be flexible and with steel core. The rope shall be fastened to the drum with an attachment having strength at least equal to that of the rope. Rope shall be of sufficient length so that minimum two full pass shall remain on drum at extreme low position of the hook.

**27.5.10. Rope Drum.** The rope drum shall be machined from seamless pipe or fabricated pipe. Rope drum shall be ultrasonic (both straight and angle beam technique), chemical and physical tested. Drum shall have flanges on both sides. The rope drum shall be connected to gear box output shaft with drum coupling

**27.5.11. Bearings.** All the bearings used shall be of suitable heavy-duty adequate antifriction type. Self-aligned roller bearings shall be used. All the bearings shall have adequate load carrying capacity. The mounting of the bearing shall be design for ease of maintenance.

**27.5.12. Girder.** The main girders shall be fabricated from structural plates with minimum nos of butt joints.100% radiography test shall be carried out for butt joints. Suitable vertical and horizontal stiffeners shall be used for fabrication of girder. The girder in U-shape prior to painting,,.shall be offered for in section to purchaser.

**27.5.13. Guards.** Effective guards shall be provided for rotating shafts, couplings, chain drives, all moving parts on the bridge and cross trolley and sheaves of hook blocks.

**27.5.14. Centralised Greasing and Lubrication System.** The crane shall be provided with group lubrication system using hand pump. The individual group lubricating point shall be accessible easy.

**27.5.15. Capacity Plate. A** plate mention in grated capacity of hoist, year of manufacture etc. shall be placed so as to be easily legible to read from the grounds.

**27.5.16. Design Requirements: Electrical**

**27.5.16.1. Motors**

(1) All motors shall be suitable for operation using VFD drive, constant torque, squirrel cage, totally enclosed fan cooled induction motors. Motor shall conform to latest minimum Class F insulation.
(2) The motors shall be suitable for reversing and frequent acceleration and with mechanical brake.
(3) The motors shall be operating on 380~440V, 3phase, 50Hz AC electrical supply. The motors should operate satisfactorily for Voltage, Frequency variation. Duty of motor with cyclic duration factor (CDF).
(4) All motors shall be provided with HRC fuses, contactors with suitable overload relays and safety devices for protections against overload, under/over voltage, phase sequence and phase failure.

(5) Type / Routine test certificates for all motors shall be provided by the Vendor/OEM in accordance with relevant standard

**27.5.17. Brakes.** The Main and Aux hoisting shall be provided with two electromechanical shoe type brakes (one hydraulic thruster operated and the other solenoid operated). The long and cross travel motions shall be provided with single electromechanical brake.

**27.5.18. Main Isolater. A** suitable switch fuse unit with fuse holder for 3 phase A.C supply for crane shall be provided at suitable position at one end of long travel of the crane and installed in a dust tight metal enclosure with a dust tight door. The door should be provided with suitable inter locking mechanism to cut off the electrica l supply to the crane when the door is in open position for any maintenance. Provision of RYB lamp indication shall be there at either end of direct supply line (DSL).

**27.5.19. Controls and Control System**

(1) Crane shall be operated with floor operated push button pendant and capable of withstanding rough handling without being damaged and shall be effectively secured and earthed. The pendant shall be of light weight and latest design.

(2) Stop, start and directional changes shall be accomplished by reversing magnetic contactors, by push buttons operating a control circuit. In all cases the push buttons shall be spring-loaded and shall return to off positions when released. They shall be suitably interlocked such that the push buttons of two reverse motions (hoist up and down etc.) cannot be simultaneously operated.

(3) All control equipment shall be suitable for operation on 220V AC, single phase 50 Hz. Electrical supply to the controls shall be provided from electrical panel mounted on the bridge.

(4) The weight of the pendant shall be supported independently by means of chain or wire ropes. If the pendant is of metal, it should be effectively earthed at two places.

(5) In addition to wired push button pendant, it is required to have radio remote with provision to prevent simultaneous operations from both pendants.

**27.5.20. Power System**

(1) Power supply of 415V, 3 phase, 4 wire, 50 Hz AC shall be provided from separate electrical panels for each motion mounted on the bridge. All these panels shall be provided with suitable dust tight doors with power on indications (RYB).

(2) Separate isolating switches shall be provided for the main power supply and power supplies to individual panels provided.

(3) The arrangements shall be there for 3 phase and 2 phase supply point (adequate numbers) on the crane plat form for maintenance work at either end of platform.

**27.5.21. Contactors**

(1) All the contactors shall be rated to permit 150 switching operations per hour.

(2) Reversing contactors shall be provided with electrical and mechanical interlocks between forward and reverse contactors, additional auxiliary contacts shall be provided.

(3) The contactors shall be provided with a three element, positive acting, ambient temperature compensated, time lagged, hand reset type thermal overload relays with adjustable setting to suit the rated motor current.

**27.5.22. Cables and Conduits.** All wiring shall be done in a neat and workman like manner and wherever possible shall be run in the conduits/trays wherever possible.

**27.5.23. Safety Earthing.** Crane structure, motor frames and metal cases of all electrical equipment including metal conduits and cable guards shall be effectively earthed with copper conductor

**27.5.24. Limit Switches**

(1) Automatic reset type of limit switches of suitable design shall be provided to prevent over travel for bridge, trolley and·hoists.

(2) Two different types of limit switches are desirable for hoisting motion of the crane. One is the rotary limit switch (metallic) with a positively acting mechanism which cuts off the electrical supply and stops the hoisting when the hook approaches the pre-determined level to prevent over winding and over lowering and the other is the linear limit switch actuated by gravity load to cut off hoisting up motion with audio/visual alarm.

(3) The linear limit switches for bridge and trolley motions shall be located in advance of the mechanical stops so that even if they were, moving at full speed at the time of limit switch actuation, the same shall be brought to a halt without excessive impact with the mechanical stops. Redundancy to be provided by one more set of limit switch in series at either end for cut of these motion.

**27.5.25. VWF Drives**

(1) In order to achieve smooth operation, all drives for hoisting, L.T & C.T motion shall be given through VVVF Controlled drives

(2) The VFD for hoisting motion shall be suitable for its operation in closed loop feedback using encoder. The encoder shall be mounted on motor shaft/Gear box input shaft.

(3) The drive power ratting shc1Il be selected based on the selected motor power and condition. The dynamic braking resistor shall be provided with suitable rating for LT, CT and hoisting motions.

(4) It is required to operate the motion for three speed i.e 100%, 50% & 10% of rated speed for all motions. All c0ntrol hardware shall be selected for above mentioned requirements.

**27 .5.26. Electrical Supply Leads and Current Collectors**

27.5.26.1. It is desirable to provide electric supply to crane bridge (LT) through Shrouded down shop Leads of suitable copper conductor. For cross travel festooned type, flexible insulated cables mounted on rollers are preferable. The track trailing able system with "T" track trolleys with supporting bracket, "T" track trolleys, copper conductor power and control cable, rollers, junction boxes complete. Wire rope/chain shall be provided all along the trailing cable to avoid strain on the cable during operation. All the conductors shall be so arranged such that they are easily accessible for maintenance.

**27.5.26..2.** Current collectors for use with the DSL conductors shall be of sliding type and shall ensure continuous contact and avoid sparking as far as possible and easily approachable for maintenance.

## MATERIAL REQUIREMENTS

**27.5.27.** All material used shall be strictly as per approved international practices, manufacturer's specifications ··md Designer Requirements.

27 **5.28.** Designing shall be carried out by approved consultant and procurement shall be made from approved :nanufacturer/vendor/supplier.

## CONSTRUCTION REQUIREMENTS

**27.5.29.** All materials used shall be of sound quality and shall conform to latest relevant standards as given below:

(1) Steel Plates: FEM, CMM, ASTM or equivalent.
(2) High Tensile Bolts: BS-970(EN-24) or equivalent.
(3) Hooks and Clevises: CMM Class 3A and High Tensile steel.
(4) Steel Pinions/Gears: BS-970(EN-24/EN-19) or equivalent.
(5) Steel Shafts and Axles: BS-970(EN-9/EN-8) or equivalent.
(6) Pins and Screws: BS-970(EN-8) or equivalent.
(7) Steel Castings: FEM or CMM Grade.
(8) Steel Forgings, Hook: FEM or CMM, class lll carbon percentage (0.25 to 0.35.) Block crosshead.
(9) Hoisting rope FEM or CMM, High Strength steel, 36 x 6 Constructions or Equivalent.
(10) Rails for LT & CT FEM or CMM, 50C12 (105lbs/yard or 52.1Kg/m).
(11) Wheels: En-9 forged
(12) Rope drum: ASTM 106 Gr-A/B

## SUB SECTION 27-6

## DIESEL GENERATOR SET

**27.6.1. Introduction.** DG sets are comprised of Diesel Engine & Alternator and coupled on common bed plate. In case of electric shutd0wn Diesel Generators are used as a stand-by source of supply in sensitive/remote areas keeping in view the operational requirements.

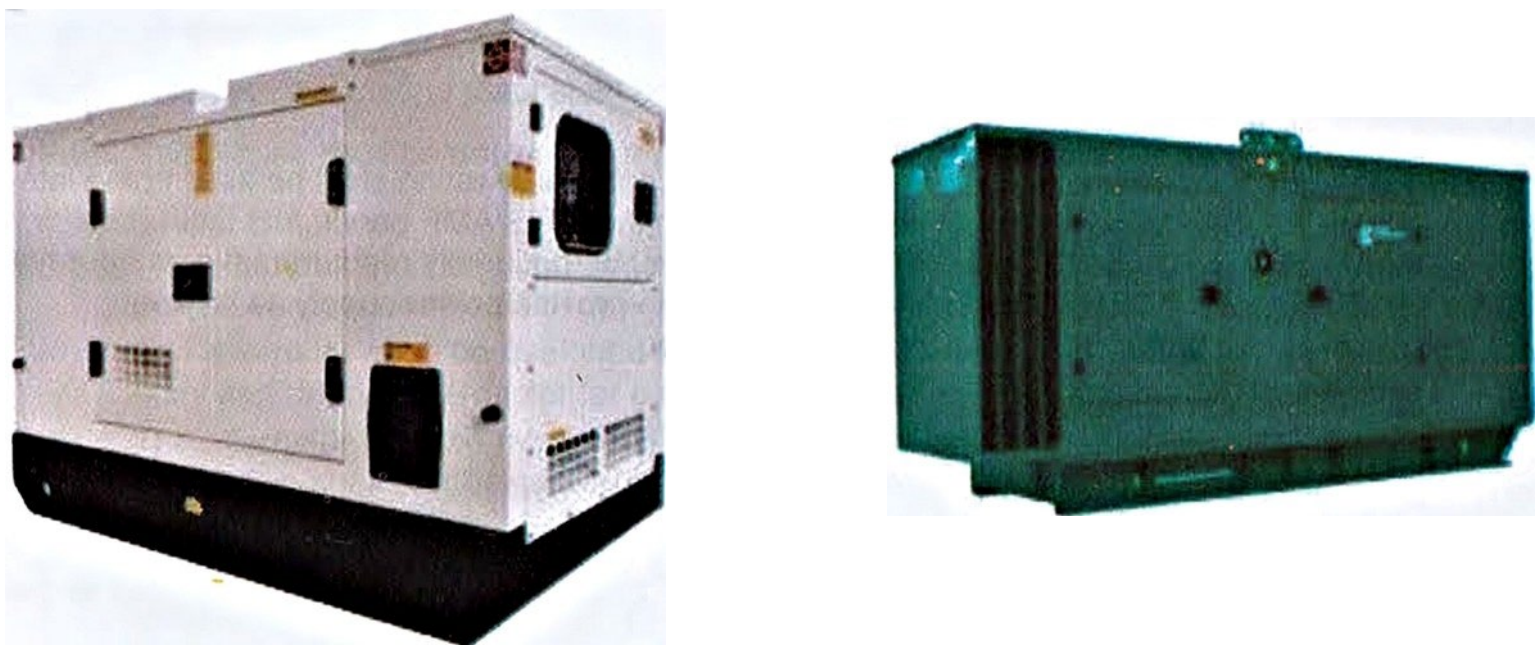


**FIGURE 27-17: DIESEL GENERATOR SET**

**27.6.2. Diesel Engine.** Diesel Engine 4 stroke water cooled, electric start, all as required. The engine will be fitted complete including the following accessories:-

(1) Flywheel to suit flexible coupling
(2) Flexible coupling
(3) Exhaust gas turbo charger
(4) Automatic safety control in case of high water temperature
(5) Automatic safety control in case of low lubrication oil pressure
(6) Automatic over speed trip protection
(7) Lubrication oil pump
(8) Lubrication oil filter
(9) Lubrication oil pan
(10) Lube oil By-Pass filter
(11) Fuel pump
(12) Fuel filter
(13) Hoses for fuel tank
(14) Air intake manifold
(15) Air cleaner dry type
(16) Electronic Governor
(17) Self Starter
(18) Alternator for battery charging
(19) Flexible pipe for silencer

27.6.2.1. Engine mounted Instrument Panel fitted with and having digital display for following:-

(1) Push button/ Start-stop switch with key
(2) Water temperature indication
(3) Lubrication oil pressure indication
(4) Lubrication oil temperature indication
(5) Battery charging indication
(6) RPM indication
(7) Over speed indication
(8) Low lubrication i.e. Oil trip indication
(9) Engine Hours indication

**27.6.3. Alternator.** Synchronous alternator rated, 415 volts at 1500 RPM, 3 phase 50 Hz, AC supply with 0.9 lagging power factor at site condition. The alternator shall be having SPDP enclosure, brushless, continuous duty, self-excited and self-regulated through AVR

(1) Base Frame & Foundation
(2) Fuel Tank
(3) Exhaust System
(4) Starting System

**27.6.4. Diesel Generator Sets**

27.6.4.1 **Standards** & **Specifications**

27.6.4.1.1 **Technical Requirements.** Diesel Generator (DG) unit with prime rating shall be assembled integrated/ manufactured in EU, UK & USA. All components i.e. engine, alternator, ATS/AMF panel, fuel tank, radiator, canopy etc. EU, UK & USA manufactured. The Coupler of DG unit shall be internationally reputed make as approved by E-IN-C's approved list of equipment. The DG unit shall be designed to provide power supply as follows:

(1) Capacity as required
(2) Nominal system voltage 400/230 V
(3) Highest system voltage 440/253 V
(4) No. of phases 3 Phase 4 wire
(5) Frequency 50 Hz environmental conditions
(6) Altitude 1000 meter above sea level (above 1000 metres altitude DG set be derated as per actual altitude)
(7) Ambient outdoor temp Maximum 50°C
(8) Maximum outdoor daily average 40°C
(9) Maximum outdoor daily yearly 40°C Minimum outdoor temp-10°C
(10) Highest one day variation 25°C Relative Humidity
(11) Maximum 92%
(12) Minimum 12%
(13) Yearly Average 44%

27.6.4.1.2 The DG unit shall be designed, manufactured and tested in compliance with the test versions of the following standards:-

(1) IEC 60034 rotating electrical machine
(2) IEC 60085 Thermal evaluation and classification of electrical insulation
(3) IEC 60529 Degree of protection provided by enclosures IP code
(4) BS-5514, DIN-6271 & AS-2789 for reciprocating internal combustion engine
(5) 2041/30/EU Electromagnetic compatibility
(6) 2000/14/EC Noise emission for outdoor use
(7) ISO 10816 Specification for mechanical performance (vibration)
(8) ISO 3046 Specification for reciprocating internal combustion engines
(9) Factory design system built according to ISO-9001:2015 EU and USA certified
(1O) SI 426 European commission (dangerous substances) classification, packing, labeling, and notification of regulations 1992
(11) CIMAC Congress International des Machine a Combustion recommendation for diesel engine acceptance test.
(12) All Gen Set should be compliance with health standards ROHS (Restriction of Hazard Substance)

**27.6.5. Diesel Engine.** The diesel engine shall comply with the specified international IEC standard or equivalent standard and shall be of four stroke, multi cylinder, water-cooled, cold start, direct fuel injection, compression ignition and preferably turbo-charge type. The crankshaft speed shall not exceed 1500 rpm.

27.6.5.1. **Performance**

(1) The DG set shall be capable of delivering full load as generator rating under the service condition.
(2) Voltage regulation ± 0.5%
(3) Frequency regulation: Random frequency variation with any steady load from no load to full load shall not exceed± 0.25%.

**27.6.6. Speed Governor.** The engine shall be fitted with an automatic speed governor.

**27.6.7. Shutdown System.** The engine shall be fitted with a mechanical operated device, which will shut off the fuel supply due to any fault occurrence. The generator shall shutdown automatically under the following conditions:-

(1) Low oil pressure
(2) High engine temperature
(3) Low fuel level
(4) Over/under speed
(5) Battery charge fail

**27.6.8. Safety Guard.** All rotating parts shall be adequately in order to prevent danger to personnel

**27.6.9. Fuel.** The engine shall be designed for operation on Diesel Fuel

**27.6.10. Alternator**

(1) The alternator shall be synchronous, four pole and brushless excitation type and shall comply with the relevant requirements of specification IEC 60034 or and equivalent international standard.
(2) The alternator shall be designed for operation 10% engine overload at any power factor between unity and rated power factor for a maximum period as permitted by ISO 3046/11.
(3) The alternator shall be rated for IP-23 protection the insulation of the winding shall be of class "H". All winding shall be tropicalized and suitably impregnated to withstand ambient conditions.
(4) The alternator shall be complete with necessary cooling fans, excitation and voltage regulating equipment. The alternator shall be capable of maintaining its continuous maximum output (rated) when operating within + 5% of rated voltage and at rated power factor.
(5) The alternator shall be brushless rotating field, self-existing and self-regulating type complete with permanent magnets and fully connected damper winding. The stator winding shall be star connected and shall be brought out together with a neutral point to terminals located in steel sheet box mounting on top of the generator to facilitate connection of power cable of suitable capacity. The following protection shall be provided for the alternator:-
    (a) Over Current Protection
    (b) Earth Fault Protection

**27.6.11. Mounting.** Complete unit to be mounted on robust skid frame vibration mountings shall be used where required. Skid frame to be dimensioned to accommodate generator/alternator assembly, all accessories, sound proof canopy. Skid frame must be of rigid construction suitable for locating on level ground surfaces ranging from compact earth to concrete.

**27.6.12. Automatic Transfer Switch (ATS).** The ATS shall comply with IEC 60947 or equivalent international standard. The separately mounted generator control cubicle and ATS shell be of steel sheet vermin proof lockable hinged door. Four pole circuit breaker or magnetic contactors should be provided rated for full load of the current (+ 10% overload). The ATS shall be of electrical and mechanical inter locked.

**27.6.13. Control Panel**

(1) The control panel shall have the following provision for the control of DG set.
(2) Master engine control Switch for Off/Auto/Manual/Test with a facility for starting and stopping the DG set.
(3) Selectable multifunction meter
(4) Engine control monitor
(5) Alternator voltage/current monitor
(6) Engine hours run counter
(7) Volt, ampere and frequency meter
(8) Noiseless acoustic canopy

## SUB SEC-27-7

## MEDICAL GASES

**27.7.1.** Medical gases are critical to the function of hospitals and many other health care facilities. Knowing the most common types of gases, understanding how each is used and then how to maintain the concerned systems for each gas will ensure the facility's success. Five common types of medical gases used in hospitals are as under:-

(1) **Medical Air** - used in the ICU and NICU areas, medical air is supplied by a specific air compressor to patient care areas.

(2) **Oxygen** - a medical gas required in every healthcare setting and is used for resuscitation and inhalation therapy.

(3) **Carbon dioxide** - used for less invasive surgeries

(4) **Nitrogen (Medical Liquid Nitrogen)** - a medical gas used for cryosurgery removal of some cancers and skin lesions.

(5) **Nitrous Oxide** - a medical gas is used in numerous surgical procedures as both an anesthetic and analgesic.

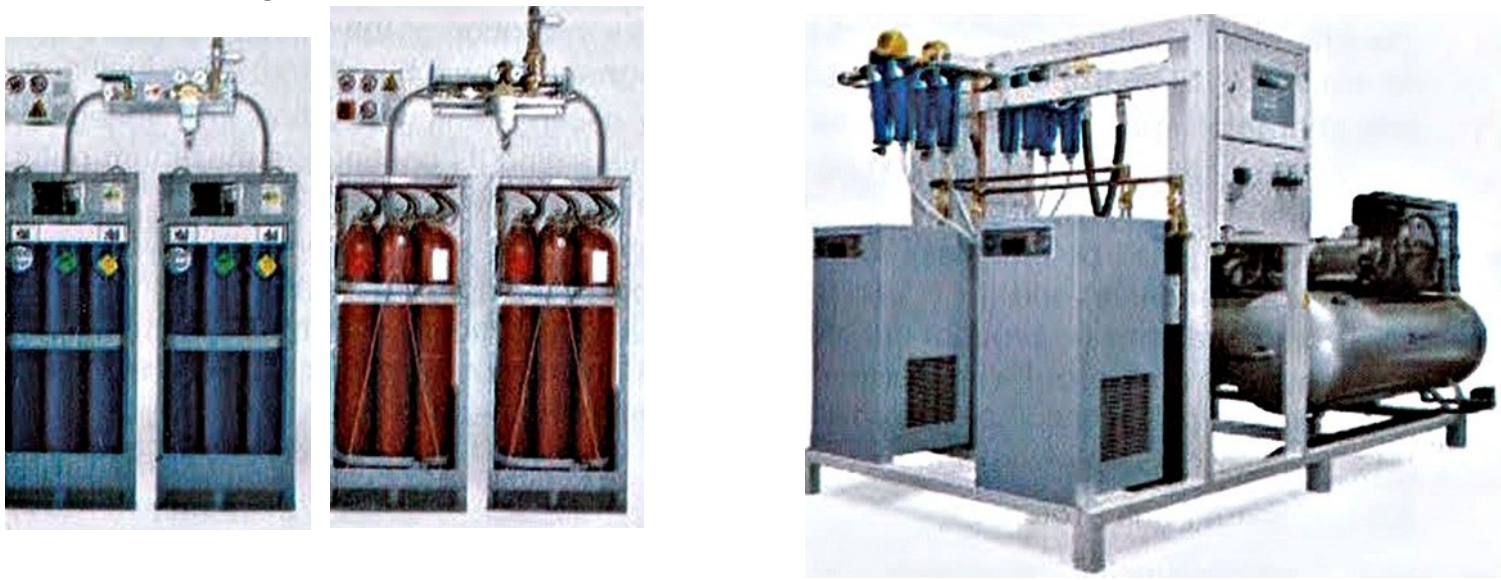


**FIGURE 27-18 : MEDICAL GASES CYLINDER & PLANT**

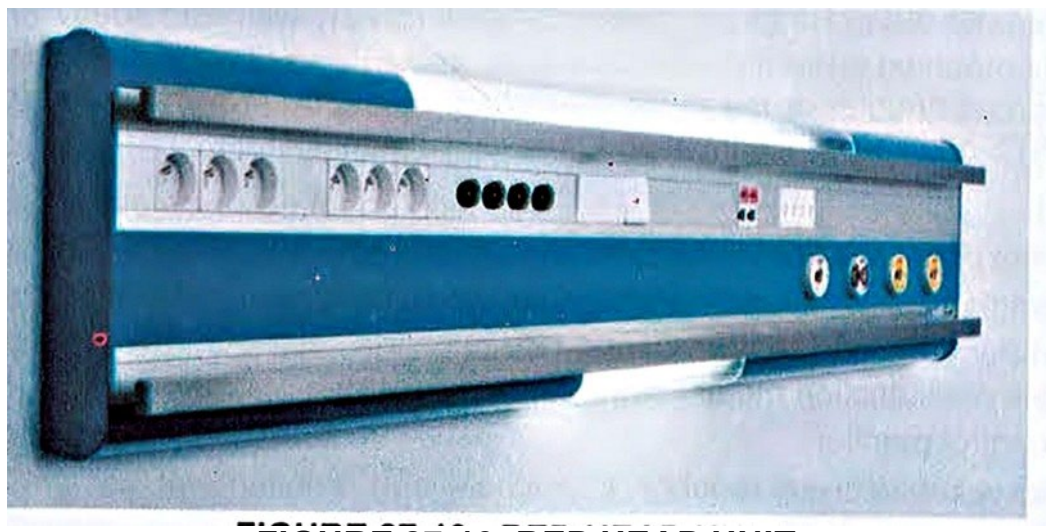


**FIGURE 27-19: BED HEAD UNIT**

**TABLE 27-4**
**Medical Gas Systems**
**Medical Gas Demand**

| Gas / Service | Application |
|---|---|
| Oxygen | Analgesia, patient care, lab use |
| Nitrogen | Surgical trubo-driven equipments, lab use |
| Nitrous Oxide | Analgesia, patient care, lab use |
| Medical Air | Drying, air driven tools, lab use |
| Medical Vacuum | Cardiac arrest, suction of waste materials, tubes drying, lab use |

Medical equipment is connected to the gas system through quick coupler mechanisms

- Each coupler is color coded
  - o O2-Green
  - o Air- Yellow
  - o N2O-blue
  - o Vacuum - white

**FIGURE 27-20 : CENTRAL GAS SYSTEMS**

### 27.7.2. Standards & Specifications

27.7.2.1 **Manufacturing Process.** Degreased medical gas copper fittings will be manufactured from the same grade of copper as Copper tube and are end feed type in accordance with the requirements of BS EN 1254. Degreased medical gas copper fittings are available in the following variations. The variations come in the following sizes 12 mm to 219 mm

(1) 90° Elbow
(2) Equal Tee
(3) Straight Coupling
(4) Reducing Tees
(5) Reducing Couplings
(6) Fitting Reducers
(7) 45°Elbow
(8) End Caps
(9) Street Elbows

**27.7.3. Copper Tubes.** Degreased copper tube is to be used in Medical gas pipeline system (MGPS) installations and to be incorporated the specialist requirement of the MGPS industry to include cleanliness, packaging and usability required to attain the levels of quality as stated particularly in HTM 02-01.It should be used for jointing degreased medical copper fittings and !Other medical gas equipment complaint to BS EN 13348, BS EN 1057, BS 2871 Part 1 Table X, EN 7396, HTM \2022 and HTM 02-01. Degreased copper tube be suitable for use with the following medical gases:-

(1) Oxygen
(2) Nitrous Oxide
(3) 50% Oxygen/SO% Nitrous Oxide mixture
(4) Medic-al Air (for breathing)
(5) Surgical Air (for tools)
(6) Medical Vacuum
(7) Degreased medical gas copper fittings will be used for jointing degreased medical gas copper tube pipelines complaint to BS EN 13348, BS EN 1057 and BS 2871 Part 1 Tab.le X as quoted in HTM 02-01 qnd C11.

**27.7.4. Quality.** Degreased copper tube and fittings will be manufactured under BS·EN 13485:;Medical Devices Quality Management Systems. All tube should be manufactured under strict quality controh procedures to ISO 9001:2008.

**27.7.5. CE Marking.** Degreased Copper tube and fittings will be CE marked as a class· Ila 1Medical·Device 93/42/EEC with notified body British Standards Institute and stamped CE 0086.

### 27.7.6. Engraving/Ink Marking

27.7.6.1 All copper tube from sizes 12mm through to 219mm be engraved/permanently ink marked with the following information:-

(1) The harmonized standard number EN 13348
(2) Nominal dimensions = Diameter x wall thickness mm
(3) Hardness= 1-1-1 (15-54mm Tube only)
(4) Manufacturer details
(5) DG = Degreased for Oxygen
(6) CP22 = Part No. example Copper Pipe 22 mm
(7) CE mark (CE0086)
(8) Medical = Medical Device Directive to 93/42/EEC
(9) Time, Date of Production and Batch Number

## SUB SECTION 27-8

## SOLAR SYSTEM

**27.8.1. Solar System.** Solar system is the process to convert solar energy into electric energy, solar are used in a variety of elect system. This sub-section briefly describes various types and major components of modern Solar system. Detailed specifications and guidelines are covered in technical instructions.

**27.8.2. Main Component of Solar System**

(1) Solar PV Module
(2) Mounting system
(3) Inverters
(4) AC/DC Cables network
(5) Smart meter
(6) PV System monitoring
(7) Protection System
(8) Combiner boxes (AC/DC Panel)
(9) Batteries

**27.8.3. PV Modules.** PV modules are used in a variety of environments, i.e. open fields, deserts, roof tops, farms and in sea. Many of these environments add stressors to the materials and need extra reassurance of the long-term reliability. All type PV modules i.e. crystalline, thin film, should meet the following UL's and IEC standards.

(1) Safety and type approval to UL 1703 and IEC 61730-1/-2
(2) Performance testing to IEC/UL 61215 orlEC/UL 61646, as well as IEC 61701, IEC 62716, IEC 62782, IEC 62804 and IEC 61853
(3) Name plate rating to UL 4730 and EN 50380
(4) Corrosive atmosphere resistance testing to salt mist (IEC 61701 ed.2) and ammonia (IEC 62716)
(5) Fire testing to UL 170

**27.8.4. Module Components.** Critical components of a PV module must be individually assessed to determine safety and performance compliance. The components of Module should comply following UL standards:-

(1) UL 3730 for junction boxes
(2) UL 6703 and UL 6703a for PV connectors
(3) UL Subject 248-19 and UL Subject 2579 for fuses
(4) UL 988 and UL 5081 for disconnects
(5) UL 4898 circuit breakers
(6) UL Subject 4248-18 and UL Subject 4248-19 for fuse holders
(7) UL 1741 combiner boxes

**27.8.5. Mounting Systems.** Mounting systems, mounting devices, clamping devices and ground lugs for use with photovoltaic modules and panels require testing for ground mounted systems and as part of a non-structural building component. Following standards provides safety and performance testing and listing to required standards, such as:-

(1) NEC section 690.43
(2) UL 2703

**27.8.6. Inverters.** Conformity assessment services, including safety, performance and EMC testing. The extent and scope of testing is determined in part by whether the product is a stand-alone unit (off grid) or (on grid) intended for interconnection with a local utility. Power inverters, converters and controllers be tested and in compliance with all key international and local grid standards, including:-

(1) UL 1741
(2) IEC 62109
(3) UL62109
(4) IEEE 1547
(5) IEC 62109 PV Electronic Safety Standards
(6) UL 16998 DC Arc-fault circuit Protection

**27.8.7. AC/DC Cables network.** PV modules operate at high temperatures and are exposed to a variety of environmental conditions, as a result, the insulation of module interconnection wiring may be required to be sunlight resistant and rated for wet locations at a temperature rating of 90°C or above. PV cables should meet following UL standards:

(1) UL 854 for USe-2 wire
(2) UL 4703 for PV wire which offers superior sunlight resistance
(3) UL 9703 wiring system and harnesses

**27.8.8. Smart Meters.** Utilities and consumers using smart meters to optimize the efficiency, reliability and cost of energy produced and used. In response to concerns about the potential hazards associated with smart meters, utility companies are increasingly mandating safety certification for these products. Smart meter should comply following UL standards for conformity assessment, product safety, and product compliance testing. Product compliance to these standards cover electric shock, fire and emissions safety requirements, based on the same standard that applies to all electric utility meters:-

(1) UL2735 for revenue meters
(2) UL916 for non-revenue meter
(3) ANSI C12
(4) IEC/AS 62052
(5) IEC/AS 62053

**27.8.9. PV System monitoring.** Provide a PV system monitoring panel mounted as indicated. The following quantities must be viewable from a remote local touch screen display mounted at location as indicated. Bidirectional (import KWH and export KWH) service connection meter for the purpose of net metering.

(1) DC input Voltage from PV array.
(2) DC input Power from PV system.
(3) DC input current from PV system.
(4) AC phase Current from PV system.
(5) AC Voltage from PV system.
(6) AC Real Power from PV system.
(7) Daily, Weekly, Monthly, Yearly, and Cumulative Energy Production.
(8) Fault Status Report.
(9) DC Ground Current Report
(10) AC Neutral Current from PV system.
(11) AC Reactive Power from PV system.
(12) AC Apparent Power from inverter.
(13) AC Power Factor.
(14) AC Phase Current from inverter
(15) AC Voltage from inverter
(16) AC Voltage and Current Balance.

**27.8.10.** Provide additional data acquisition sensors to measure (irradiance, wind speed, ambient temperature, PV module temperature). Any additions, data acquisition sensors, required a conduit separate from the current conductor conduit.

**27.8.11. Protection System.** The system should be provided with all necessary protections like earthing, lightning, and grid islanding:

(1) Reverse power prptection relays
(2) Export limiting devices (e.g. zero export)
(3) Ramp rate ,
(4) Power factor settings other than 1.0
(5) Additional anti-islanding provisions for inverters

**27.8.12. Lightning Protection.** The Solar PV power plants shall be provided with lightning & overvoltage protection. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

**27.8.13. Surge Protection.** Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and-ve terminals to earth ( via Y arrangement). Surge protection shall be provided on the DC side and the AC side.

(1) The DC surge protection devices (SPDs) shall be installed in the DC distribution box adjacent to the solar grid inverter
(2) The AC SPDs shall be installed in the AC distribution Cabinet / panel solar grid invertor.
(3) The SPDs earthing terminal shall be connected to earth through the above mentioned dedicated earthing system.
(4) Enclosure for AC/DC protection devices will be installed outside and must be IP 65 or higher.

(5) SPD protection device shall be provided on the DC and AC distribution box adjacent to the solar grid inverter. The SPD earhting terminal should be connected throw earthing system.

**27.8.14. Earthing Protection**

(1) Each array structure of the PVyard should be grounded/ earthed properly as per IS: 3043-1987.

(2) In addition the lighting arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of Department as and when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly.

(3) Earth resistance shall not be m_ore than 5 ohms. Duly for Equipment and System Earth.

(4) Equipment earth (DC) all metallic parts of electric facility such as PV modules, inverter, iron clad switches will be connected toe a rt h to avoid any loss of property or human being.

(5) The PV module structure component shall be electrically interconnected and grounded.

(6) The minimum two separate dedicated and interconnected earth electrode must be used for earhting system.

**27.8.15. Grid Islanding**

(1) In the event of a power failure on the electric grid, the rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

(2) A manual disconnect 4-pole isolation switch beside automatic disconnection.to grid would have to be provided.

**27.8.16. Combiner boxes (AC/DC Panel)**

(1) All combiner boxes must be listed to UL 1741, and inspected before commissioning, testing, and operation of the system.

(2) Combiner boxes shall be as provided as per design requirement (in all- mount, support structure mount) [NEMA 6/6P outdoor for coastal environment, NEMA 4/4X outdoor [NEMA 3R outdoor, steel, aluminium, stainless steel, polymeric, enclosures in accordance with NEMA 250.

(3) Combiner boxes as per design for use with the inverter provided, and coordinated to the specific PV source circuit design.

(4) Combiner boxes shall be of compact design with simplified input and output wiring.

(5) Provide over current protection and output disconnecting means that comply with the requirements of NFPA 70.

**27.8.17. Maintenance free Batteries.** Batteries should be gel type maintenance free valve regulated lead acid battery suitable for solar electric system as per IEC 60896,21-22,IEC 61427 DIN 43539 with following specification:-

| | | |
|---|---|---|
| (1) | AH efficiency | >95% |
| (2) | WH efficiency | >85% |
| (3) | Self discharge | <0.5% per week at 27°C |
| (4) | Design float life | 20 year design life at 27°c |
| (5) | Design cycle life | 5200 cycle at 20% depth of discharge at 27°C |
| (6) | Positive plate type | Tubular |
| (7) | Separator | Micro Porous synthetic SP separator |
| (8) | Electrolyte | Gel Type |
| (9) | Mounting | Mounting frame should be acid resistance |

**FIGURE 27-21 : COMPONENTS OF SOLAR SYSTEM**

## ITEM RATES

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Ducting** | | |
| 27-1 | **GI** Sheet metal ducting, complete with hangers for ceiling suspended, proper support for duct running on roof and bracing complete in all respect 26 **SWG** supply and fixing. | Sqm | 2597 |
| 27-2 | Same as Item 27-1, but 24 **SWG.** | Sqm | 2778 |
| 27-3 | Same as Item 27-1, but 22 **SWG.** | Sqm | 3010 |
| 27-4 | Same as Item 27-1, but 20 **SWG.** | Sqm | 3449 |
| 27-5 | Same as Item 27-1, but 18 **SWG.** | Sqm | 3791 |
| 27-6 | Same as Item 27-1, but fixing only. | Sqm | 705 |
| 27-7 | Same as Item 27-2, but fixing only. | Sqm | 705 |
| 27-8 | Same as Item 27 3. but fixing only. | Sqm | 705 |
| 27-9 | Same as Item 27-4, b t fixing only. | Sqm | 904 |
| 27-10 | Same as Item 27:-5, but fixing only. | Sqm | 904 |
| 27-11 | Added to Item 27-1 or 27-6, if removal only. | Sqm | 404 |
| 27-12 | Add to Item 27-2 or 27-7, if removal only. | Sqm | 404 |
| 27-13 | Add to Item 27..,3_or 27 -8, if removal only. | Sqm | 404 |
| 27-14 | Add to item 27-4 or 27-9, if removal orily/ | Sqm | 489 |
| 27-15 | Add to item 27-5 or 27-10, if remov I only. | Sqm | 489 |
| | **Insulation** | | |
| 27-16 | Fibre glass or rock wool insulation, for GI duct, 1 inch thick, supply and fixing. | Sqm | 1482 |
| 27-17 | Same as item 27-16, but 1.5 inch thickness. | Sqm | 1648 |
| 27-18 | Vapour barrier for **GI duct,** consist of 2 ply Kraft foil, with internal **fibre glass yarn** reinforcement at maximum 1 inch centre to centre. | Sqm | 4407 |
| 27-19 | External covering for ,**GI duct,** consist of coarse cloth covering. | Sqm | 260 |
| 27-20 | Sound liner thickness 1 inch, for **GI duct** where required, supply and fixing. | Sqm | 16350 |
| 27-21 | Same as item 27-20, but 2 inch thickness. | Sqm | 28774 |
| 27-22 | Same as item 27-16, but fixing only. | Sqm | 930 |
| 27-23 | Same as item 27-17, but fixing only. | Sqm | 930 |
| 27-24 | Same as item 27-18, but fixing only. | Sqm | 207 |
| 27-25 | Same as item 27-19, but fixing only. | Sqm | 207 |
| 27-26 | Same as item 27-20, but fixing only. | Sqm | 1350 |
| 27-27 | Same as item 27-21, but fixing only. | Sqm | 1800 |
| 27-28 | Added to item 27-16 or 27-22, if removal only. | Sqm | 698 |
| 27-29 | Added to item 27-17 or 27-23, if removal only. | Sqm | 698 |
| 27-30 | Added to item 27-18 or 27-24, if removal only. | Sqm | 155 |
| 27-31 | Added to item 27-19 or 27-25, if removal only. | Sqm | 155 |
| 27-32 | Added to item 27-20 or27-26, if removal only. | Sqm | 1013 |
| 27-33 | Added to item 27-21 or 27-27, if removal only. | Sqm | 1013 |
| | **Supply/ Returns Exhaust Air Diffusers** | | |
| 27-34 | Supply air diffusers, supply and fixing. | Sqm | 21702 |
| 27-35 | Return air diffusers, supply and fixing. | Sqm | 21702 |
| 27-36 | Return air grill, supply and fixing. | Sqm | 20112 |
| 27-37 | Exhaust air diffusers, supply and fixing. | Sqm | 21702 |
| 27-38 | Same as item 27-34 to 27-37, but fixing only. | Sqm | 1035 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-39 | Add to item 27-34 to 27-37 or 27-38, if removal only. | Sqm | 776 |
| 27-40 | **Balancing Valve** for chilled/hot water, 25mm dia (KITZ Japan) supply and fixing. | Each | 7279 |
| 27-41 | Same as Item 27-40, but 32mm dia. | Each | 7758 |
| 27-42 | Same as Item 27-40, but 40mm dia. | Each | 9678 |
| 27-43 | Same as Item 27-40, but 50mm dia. | Each | 11958 |
| 27-44 | Same as Item 27-40, but 65mm dia. | Each | 16878 |
| 27-45 | Same as Item 27-40, but flanged and drilled BS Table 18-1-9 75mm dia. | Each | 23987 |
| 27-46 | Same as Item 27-45, but 100mm dia. | Each | 41168 |
| 27-47 | Same as Item 27-45, but 125mm dia. | Each | 59967 |
| 27-48 | Same as Item 27-45, but 150mm dia. | Each | 94767 |
| 27-49 | Same as Item 27-45, but 200mm dia. | Each | 142767 |
| 27-50 | **Non-Return Valve** screwed 75mm dia, (Kitz Japan) flanged and drilled B.S Table 18-1-9. | Each | 11852 |
| 27-51 | Same as Item 27-50, but 100mm dia. | Each | 15848 |
| 27-52 | Same as Item 27-50, but 125mm dia. | Each | 19532 |
| 27-53 | Same as Item 27-50, but 150mm dia. | Each | 21453 |
| 27-54 | Same as Item 27-50, but 200mm dia. | Each | 34053 |
| 27-55 | **Y Strainer** 75mm dia (Kitz Japan), flanged and drilled, B.S Table 18-1-9 supply and fixing. | Each | 11132 |
| 27-56 | Same as Item 27-55, but 100mm dia. | Each | 14648 |
| 27-57 | Same as Item 27-55, but 125mm dia. | Each | 18368 |
| 27-58 | Same as Item 27-55, but 150mm dia. | Each | 22053 |
| 27-59 | Same as Item 27-55, but 200mm dia. | Each | 34053 |
| 27-60 | **Automatic Air Vent Valve,** 20mm dia (Kitz Japan) supply and fixing. | Each | 1818 |
| 27-61 | Same as Item 27-60, but 25mm dia. | Each | 2958 |
| 27-62 | Same as Item 27-40 to 27-44, 27-60 to 27-61, but fixing only. | Each | 78 |
| 27-63 | Same as Item 27-45 to 27-49, 27-50 to 27-54, 27-55 to 27-59, but fixing only. | Each | 417 |
| 27-64 | Add to Item 27-40 to 27-44, 27-60 to 27-61 and 27-62 if removal only. | Each | 262 |
| 27-65 | Add to Item 27-45 to 27-49, 27-50 to 27-54, 27-55 to 27-59 and 27-63, if removal only. | Each | 155 |
| 27-66 | Pipe line digital **thermostat,** supply and fixing (Digital). | Each | 54431 |
| 27-67 | Pipe line **pressure gauge,** supply and fixing. | Each | 18431 |
| 27-68 | Same as item 27-66 and 27-67, but fixing only. | Each | 431 |
| 27-69 | Added to item 27-66 and 27-67 or 27-68, if removal only. | Each | 324 |
| 27-70 | **Installation AC Unit,** wall mounted split type upto 1.5 Ton (except cost of **AC unit),** kit and electric wiring. | Each | 3578 |
| 27-71 | Same as item 27-70, but 2 Ton capacity. | Each | 3578 |
| 27-72 | Installation AC unit, floor mounted split type, 3 phase, 5 Ton capacity, (except cost of **AC unit),** kit, electric wiring and PCC foundation. | Each | 6705 |
| 27-73 | Same as item 27-72, but upto 10 Ton capacity. | Each | 6705 |
| 27-74 | Same as item 27-72, but upto 16 Ton capacity | Each | 18765 |
| 27-75 | Same as item 27-72, but upto 20 Ton capacity. | Each | 23160 |
| 27-76 | Same as item 27-72, but upto 25 Ton capacity. | Each | 27555 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Refrigerant Piping** | | |
| 27-77 | Copper tube¼" dia, supply and fixing. | Metre | 357 |
| 27-78 | Same as item 27-77, but 3/8 " dia. | Metre | 538 |
| 27-79 | Same as item 27-77, but 1/2 " dia. | Metre | 808 |
| 27-80 | Same as item 27-77, but 5/8 " dia. | Metre | 1003 |
| 27-81 | Same as item 27-77, but 3/4" dia. | Metre | 1297 |
| 27-82 | Same as item 27-77, but 7/8" dia. | Metre | 1526 |
| 27-83 | Same as item 27-77, but 1-1/8" dia. | Metre | 2267 |
| 27-84 | Same as item 27-77, but 1-3/8" dia. | Metre | 3005 |
| 27-85 | Same as item 27-77, but 1-5/8" dia. | Metre | 3916 |
| 27-86 | Same as item 27-77 to 27-85, but fixing only. | Each | 86 |
| 27-87 | Add to item 27-77 to 27-85 or 27-86, if removal only. | Each | 69 |
| 27-88 | Insulation elastomeric nitrite rubber Pipe for Copper tube 1/4" dia, as per complete specification, supply and fixing. | Metre | 105 |
| 27-89 | Same as item No. 27-88, but size 3/8 "dia. | Metre | 111 |
| 27-90 | Same as item 27-88 but 1/2 "dia. | Metre | 117 |
| 27-91 | Same as item No.27-88, but size 5/8" dia supply. | Metre | 123 |
| 27-92 | Same as item No.27-88, but size 3/4" dia. | Metre | 129 |
| 27-93 | Same as item No.27-88, but size 7/8" dia. | Metre | 135 |
| 27-94 | Same as item No.27-88, but size 1-1/8" dia. | Metre | 165 |
| 27-95 | Same as item No.27-88, but size 1-3/8" dia. | Metre | 183 |
| 27-96 | Same as item No.27-88, but size 1-5/8" dia supply and fixing. | Metre | 213 |
| 27-97 | Same as item 27-88 to 27-96, but fixing only. | Metre | 69 |
| 27-98 | Add to item 27-88 to 27-96 or 27-97, if removing only. | Metre | 52 |
| 27-99 | Supply & Fixing, M.S Stand/wall bracket for outdoor unit 0.75 to 1.5 ton. | Each | 2141 |
| 27-100 | Same as item 27-99, but unit 2 to 4 ton. | Each | 2591 |
| 27-101 | Same as item 27-99 to 27-100, but fixing only. | Each | 173 |
| 27-102 | Add to item 27-99 to 27-101, 27-102, if removal only. | Each | 86 |
| | **VRF (ASIAN ORIGIN)** | | |
| 27-103 | Supply, fixing, testing and commissioning of heat & cool VRF, **DC Inverter** type system, with 1 x digital scroll enhance vapour injection compressor, including indoor unit, communications cables, copper tubing from outdoor unit to indoor unit with proper insulation, condensate drain UPVC pipe, vacuuming of complete system, pressure/flushing of complete network with nitrogen gas and charging of refrigerant R-410-A, complete all as specifications, manufacturer instructions, rated capacity 8HP suitable on electric supply 410volts, 3ph, with NL, 50HZ, complete in all respect with following protection:-<br><u>Compressor protection</u><br>a. Compressor suction<br>b. Exhaustion Pressure Protection<br>c. Compression Ratio Protection<br>d. Exhausting temperature protection<br>e. Oil Return protection<br><u>Inverter Protection</u><br>a. Inverter temperature protection<br>b. Voltage Protection<br><u>System Protection</u><br>a. Ventilator pressure protection<br>b. Four-way valve protection | Complete | 1021853 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | c. Indoor and outdoor temperature protection<br>d. Sub cooling protection<br>Electric Protection<br>a. Voltage phase-failure<br>b. Current protection<br>c. Motor protection<br>d. Protecting from Lightening<br>(Complete in all respects) | | |
| 27-104 | Same as item 27-103, but rated capacity 10HP. | Complete Job | 1241503 |
| 27-105 | Same as item 27-103, but rated capacity 12HP. | Complete Job | 1453866 |
| 27-106 | Same as item 27-103, but rated capacity 14HP. | Complete Job | 1657493 |
| 27-107 | Same as item 27-103, but rated capacity 16HP. | Complete Job | 1803136 |
| 27-108 | Same as item 27-103, but rated capacity 18HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 1966319 |
| 27-109 | Same as item 27-103, but rated capacity 20HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 2132928 |
| 27-110 | Same as item 27-103, but rated capacity 22HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 2679346 |
| 27-111 | Same as item 27-103, but rated capacity 24HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 2898996 |
| 27-112 | Same as item 27-103, but rated capacity 26HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 311135-9 |
| 27-113 | Same as item 27-103, but rated capacity 28HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 3314987 |
| 27-114 | Same as item 27-103, but rated capacity 30HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 3460628 |
| 27-115 | Same as item 27-103, but rated capacity 32HP, with 2 x digital scroll enhance vapour injection compressor. | Complete Job | 3623812 |
| 27-116 | Same as item 27-103, but rated capacity 34HP, with 3 x digital scroll enhance vapour injection compressor. | Complete Job | 4149234 |
| 27-117 | Same as item 27-103, but rated capacity 36HP, with 3 x digital scroll enhance vapour injection compressor. | Complete Job | 4361597 |
| 27.-118 | Same as item 27-103, but rated capacity 38HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 4442036 |
| 27-119 | Same as item 27-103, but rated capacity 40HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 4710866 |
| 27-120 | Same as item 27-103, but rated capacity 42HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 4914494 |
| 27-121 | Same as item 27-103, but rated capacity 44HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 5060137 |
| 27-122 | Same as item 27-103, but rated capacity 46HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 5281303 |
| 27-123 | Same as item 27-103, but rated capacity 48HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 5426947 |
| 27-124 | Same as item 27-103, but rated capacity 50HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 5590130 |
| 27-125 | Same as item 27-103, but rated capacity 52HP, with 4 x digital scroll enhance vapours injection compressor. | CC!>mplete Job | 5735773 |
| 27-126 | Same as item 27-103, but rated capacity 54HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 5898956 |
| 27-127 | Same as item 27-103, but rated capacity 56HP, with 4 x digital scroll enhance vapours injection compressor. | Complete Job | 6065566 |
| 27-128 | Same as item 27-103, but rated capacity 58HP, with 6 x digital | Complete Job | 6232175 |

| j Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | scroll enhance vapours injection compressor. | | |
| 27-129 | Same as item 27-103, but rated capacity 60HP, with 6 x digital scroll enhance vapours injection compressor. | Complete Job | 6398784 |
| 27-130 | Same as item 27-103, but rated capacity 62HP, with 6 x digital scroll enhance vapours injection compressor. | Complete Job | 7084440 |
| 27-131 | Same as item 27-103, but rated capacity 64HP, with 6 x digital scroll enhance vapours injection compressor. | Complete Job | 7247623 |
| 27-132 | Same as item 27-103 to 27-114, but fixing only. | Complete Job | 24000 |
| 27-133 | Same as item 27-115 to 27-123, but fixing only. | Complete Job | 36000 |
| 27-134 | Same as item 27-124 to 27-127, but fixing only. | Complete Job | 42000 |
| 27-135 | Same as item 27-128 to 27-131, but fixing only. | Complete Job | 48000 |
| 27-136 | Add to item 27-103 to 27-114 or 27-132, if removal only. | Complete Job | 12000 |
| 27-137 | Add to item 27-115 to 27-123 or 27-133, if removal only. | Complete Job | 18000 |
| 27-138 | Add to item 27-124 to 27-127 or 27-134, if removal only. | Complete Job | 21000 |
| 27-139 | Add to item 27-128 to 27-131 or 27-135, if removal only. | Complete Job | 24000 |
| | **Indoor Unit** | | |
| 27-140 | Supply & fixing, testing and commissioning of VRF indoor unit, cassette type, 4-way, suitable operation on AC220 volts, 50HZ, electric supply, complete in all respects, rated capacity 0.75 Ton. | Complete Job | 51600 |
| 27-141 | Same as item 27-140, but rated capacity, 1 Ton. | Complete Job | 54000 |
| 27-142 | Same as item 27-140, but rated capacity, 1.25 Ton. | Complete Job | 75600 |
| 27-143 | Same as item 27-140, but rated capacity, 1.50 Ton. | Complete Job | 81000 |
| 27-144 | Same as item 27-140, but rated capacity, 2 Ton. | Complete Job | 108000 |
| 27-145 | Same as item 27-140, but rated capacity, 2.50 Ton. | Complete Job | 135000 |
| 27-146 | Same as item 27-140, but rated capacity, 3 Ton. | Complete Job | 162000 |
| 27-147 | Supply, fixing, testing and commissioning of VRF indoor unit wall mounted type, suitable operation on AC220 volts, 50 HZ, electric supply, complete in all respects, rated capacity 0.75 Ton. | Complete Job | 38400 |
| 27-148 | Same as item 27-147, but rated capacity, 1 Ton. | Complete Job | 42000 |
| 27-149 | Same as item 27-147, but rated capacity, 1.25 Ton. | Complete Job | 57000 |
| 27-150 | Same as item 27-147, but rated capacity, 1.50 Ton. | Complete Job | 63000 |
| 27-151 | Same as item 27-147, but rated capacity, 2 Ton. | Complete Job | 84000 |
| 27-152 | Same as item 27-147, but rated capacity, 2.50 Ton. | Complete Job | 105000 |
| 27-153 | Same as item 27-147, but rated capacity, 3 Ton. | Complete Job | 126000 |
| 27-154 | Same as item 27-140 to 27-143, 27-147 to 27-150, but fixing only. | Complete Job | 4000 |
| 27-155 | Same as item 27-144 to 27-146, 27-151 to 27-153, but fixing only. | Complete Job | 4500 |
| 27-156 | Add to item 27-140 to 27-143, 27-147 to 27-150 or 27-154, if removal only. | Complete Job | 2000 |
| 27-157 | Add to item 27-144 to 27-146, 27-151 to 27-153 or 27-155, if removal only. | Complete Job | 2250 |
| | **Air Cooled Self Contained Package Air - Conditioners** | | |
| 27-158 | Supply, installation, testing and commissioning of Package Air Conditioning Units with compressors, electrical controls, temperature & pressured controls with special designed heat exchange coils must be of USA / EU origin to work at high ambient temperature perfectly. Unit must be completely wired, piped, charged and run tested in the factory before shipment to minimize installation time. Complete in all respect, 5 ton capacity. | Each | 1125000 |
| 27-159 | Same as item 27-158, but 7.5 ton Capacity. | Each | 1687500 |
| 27-160 | Same as item 27-158, but 10 ton Capacity. | Each | 2250000 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-161 | Same as item 27-158, but 12 TR Capacity. | Each | 2700000 |
| 27-162 | Same as item 27-158, but 15 ton Capacity. | Each | 3375000 |
| 27-163 | Same as item 27-158, but 20 ton Capacity. | Each | 4560000 |
| 27-164 | Same as item 27-158, but 25 ton Capacity. | Each | 4980000 |
| 27-165 | Same as item 27-158, but 30 ton Capacity. | Each | 5400000 |
| 27-166 | Same as item 27-158, but 40 ton Capacity. | Each | 7200000 |
| 27-167 | Same as item 27-158, but 50 ton Capacity. | Each | 9840000 |
| 27-168 | Same as item 27-158, but 60 ton Capacity. | Each | 10560000 |
| 27-169 | Same as item 27-158, but 70 ton Capacity. | Each | 11760000 |
| | **Air Cooled Self Contained Package Air - Conditioners (Asian Origin)** | | |
| 27-170 | Supply, installation, testing and commissioning of Package Air Conditioning Units, with compressors, electrical controls, temperature & pressured controls, with special designed heat exchange coils, to work at high ambient temperature perfectly. Unit must be completely wired, piped, charged and run tested in the factory before shipment to minimize installation time. Complete in all respect, 5 ton capacity. | Each | 912000 |
| 27-171 | Same as item 27-170, but 7.5 ton Capacity. | Each | 1176000 |
| 27-172 | Same as item 27-170, but 10 ton Capacity. | Each | 1411200 |
| 27-173 | Same as item 27-170, but 12 ton Capacity. | Each | 1881600 |
| 27-174 | Same as item 27-170, but 15 ton Capacity. | Each | 2352000 |
| 27-175 | Same as item 27-170, but 20 ton Capacity. | Each | 2822400 |
| 27-176 | Same as item 27-170, but 25 ton Capacity. | Each | 3528000 |
| 27-177 | Same as item 27-170, but 30 ton Capacity. | Each | 4704000 |
| 27-178 | Same as item 27-170, but 40 ton Capacity. | Each | 5880000 |
| 27-179 | Same as item 27-170, but 50 ton Capacity. | Each | 7056000 |
| 27-180 | Same as item 27-170, but 60 ton Capacity. | Each | 8232000 |
| 27-181 | Same as item 27-170, but 70 ton Capacity. | Each | 10584000 |
| 27-182 | Same as item 27-158 to 27-161 or 27-170 to 27-173, but fixing only. | Each | 9000 |
| 27-183 | Same as item 27-162 to 27-165 or 27-174 to 27-177, but fixing only. | Each | 22500 |
| 27-184 | Same as item 27-166 to 27-169 or 27-178 to 27-182, but fixing only. | Each | 52500 |
| 27-185 | Add to item 27-158 to 27-161, 27-170 to 27-173 or 27-182, if removal only. | Each | 4500 |
| 27-186 | Add to item 27-162 to 27-165, 27-174 to 27-177 or 27-183, if removal only. | Each | 11250 |
| 27-187 | Add to item 27-166 to 27-169, 27-178 to 27-182 or 27-184, if removal only. | Each | 26250 |
| | **Air Handling Unit** | | |
| 27-188 | Supply, installation, testing and commissioning of AHU **(Normal)** with refrigerant, copper piping as specified of EU/US origin with AHRI/ Euro-vent certified of 10 Ton, suitable on AC supply 400V, 3 phase, 50 HZ complete all as specified. | Each | 1285625 |
| 27-189 | Same as item 27-188, but 15 ton Capacity. | Each | 1658914 |
| 27-190 | Same as item 27-188, but 20 ton Capacity. | Each | 2081506 |
| 27-191 | Same as item 27-188, but 25 ton Capacity. | Each | 2459550 |
| 27-192 | Same as item 27-188, but 30 ton Capacity. | Each | 2820272 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-193 | Same as item 27-188, but 35 ton Capacity. | Each | 3174115 |
| 27-194 | Same as item 27-188, but 40 ton Capacity. | Each | 3510341 |
| 27-195 | Same as item 27-188, but 45 ton Capacity. | Each | 3720267 |
| 27-196 | Same as item 27-188, but 50 ton Capacity. | Each | 4074840 |
| 27-197 | Same as item 27-188, but 55 ton Capacity. | Each | 4347608 |
| 27-198 | Same as item 27-188, but 60 ton Capacity. | Each | 4652337 |
| 27-199 | Supply, installation, testing and commissioning of AHU **(Hygiene)** with refrigerant copper piping all as specified of EU/US origin with AHRI/Euro-vent certified of 10Ton, capacity, suitable on AC supply, 400V, 3ph, 50 HZs, complete all spd. | Each | 1730794 |
| 27-200 | Same as item 27-199, but 15 ton Capacity. | Each | 2381725 |
| 27-201 | Same as item 27-199, but 20 ton Capacity. | Each | 2992384 |
| 27-202 | Same as item 27-199, but 25 ton Capacity. | Each | 3673901 |
| 27-203 | Same as item 27-199, but 30 ton Capacity. | Each | 4329264 |
| 27-204 | Same as item 27-199, but 35 ton Capacity. | Each | 4944121 |
| 27-205 | Same as item 27-199, but 40 ton Capacity. | Each | 5397824 |
| 27-206 | Same as item 27-199, but 45 ton Capacity. | Each | 5930597 |
| 27-207 | Same as item 27-199, but 50 ton Capacity. | Each | 6441742 |
| 27-208 | Same as item 27-199, but 55 ton Capacity. | Each | 6861373 |
| 27-209 | Same as item 27-199, but 60 ton Capacity. | Each | 7309340 |
| | **Air Handling Unit ( Asian Origin)** | | |
| 27-210 | Supply, installation, testing and commissioning of AHU **(Normal)** with refrigerant, copper piping as specified for Asian Origin 10 Ton, suitable on AC supply 400V, 3phase, 50HZs, complete all as specified. | Each | 876000 |
| 27-211 | Same as item 27-210, but 15 ton Capacity. | Each | 1404000 |
| 27-212 | Same as item 27-210, but 20 ton Capacity. | Each | 1800000 |
| 27-213 | Same as item 27-210, but 25 ton Capacity. | Each | 2196000 |
| 27-214 | Same as item 27-210, but 30 ton Capacity. | Each | 2720640 |
| 27-215 | Same as item 27-210, but 35 ton Capacity. | Each | 3054000 |
| 27-216 | Same as item 27-210, but 40 ton Capacity. | Each | 3384000 |
| 27-217 | Same as item 27-210, but 45 ton Capacity. | Each | 4044000 |
| 27-218 | Same as item 27-210, but 50 ton Capacity. | Each | 4704000 |
| 27-219 | Same as item 27-210, but 55 ton Capacity. | Each | 4764000 |
| 27-220 | Same as item 27-210, but 60 ton Capacity. | Each | 5364000 |
| 27-221 | Supply, installation, testing and commissioning of AHU **(Hygiene)** with refrigerant copper piping all as specified for Asian Origin, 10 Ton Capacity, Suitable on AC supply, 400V, 3ph, 50 HZs complete all spd. | Each | 983400 |
| 27-222 | Same as item 27-221, but 15 ton Capacity. | Each | 1331701 |
| 27-223 | Same as item 27-221, but 20 ton Capacity. | Each | 1748734 |
| 27-224 | Same as item 27-221, but 25 ton Capacity. | Each | 2170770 |
| 27-225 | Same as item 27-221, but 30 ton Capacity. | Each | 2406468 |
| 27-226 | Same as item 27-221, but 35 ton Capacity. | Each | 2593656 |
| 27-227 | Same as item 27-221, but 40 ton Capacity. | Each | 3169243 |
| 27-228 | Same as item 27-221, but 45 ton Capacity. | Each | 3495662 |
| 27-229 | Same as item 27-221, but 50 ton Capacity. | Each | 3780731 |
| 27-230 | Same as item 27-221, but 55 ton Capacity. | Each | 4215758 |
| 27-231 | Same as item 27-221, but 60 ton Capacity. | Each | 4627610 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-232 | Supply, installation, testing and commissioning of AHU **(Medical grade)** with pre & bag filters refrigerant copper piping all as specified of Asian Origin,10 Ton Capacity, Suitable on AC supply, 400V, 3ph, 50HZs complete in all respect as per drawing & specification. | Each | 2581974 |
| 27-233 | Same as item 27-232, but 15 ton Capacity. | Each | 3820374 |
| **27-234** | Same as item 27-232, but 20 ton Capacity. | Each | 5058774 |
| 27-235 | Same as item 27-232, but 25 ton Capacity. | Each | **6336774** |
| 27-236 | Same as item 27-232, but 30 ton Capacity. | Each | **7492374** |
| **27-237** | Same as item 27-188 to 27-191, 27-199 to 27-202, 27-210 to 27-213, 27-221 to 27-224 or 27-232 to 27-236, but fixing only. | Each | **18774** |
| 27-238 | Same as item 27-192 to 27-194, 27-203 to 27-205, 27-214 to 27-216 or 27-225 to 27-227, but fixing only. | Each | 33750 |
| 27-239 | Same as item 27-195 to 27-198, 27-206 to 27-209, 27-217 to 27-220 or 27-228 to 27-231, but fixing only. | Each | 45000 |
| 27-240 | Add to item 27-188 to 27-191, 27-199 to 27-202, 27-210 to. 27-213, 27-221 to 27-224, 27-232 to 27-236 or 27-237, if removal only. | Each | 9387 |
| 27-241 | Add to item 27-192 to 27-194, 27-203 to 27-205, 27-214 to 27-216, 27-225 to 27-227 or 27-238, if removal only. | Each | 16875 |
| **27-242** | Add to item 27-195 to 27-198, 27-206 to 27-209, 27-217 to 27-220, 27-228 to 27-231 or 27-239, if removal only. | Each | 22500 |
| 27-243 | Supply, installation, testing and commissioning of air cooled condensing unit (CU), direct expansion **(Dx)** type, of EU/US origin, AHRI/Euro vent certified, with power supply of 400 V, 3ph, 50 HZs with all necessary controls and compressor scroll type, semi hermetic, of 5 ton capacity, complete in all respect. | Each | 838000 |
| **27-244** | Same as item 27-243, but 10 ton Capacity. | Each | 1526005 |
| 27-245 | Same as item 27-243, but 15 ton Capacity. | Each | 2173139 |
| **27-246** | Same as item 27-243, but 20 ton Capacity. | Each | 2832496 |
| **27-247** | Same as item 27-243, but 25 ton Capacity. | Each | 3419220 |
| **27-248** | Same as item 27-243, but 30 ton Capacity. | Each | 4057807 |
| **27-249** | Same as item 27-243, but 35 ton Capacity. | Each | 4695420 |
| **27-250** | Same as item 27-243, but 40 ton Capacity. | Each | 5224891 |
| 27-251 | Same as item 27-243, but 45 ton Capacity. | Each | 5746652 |
| **27-252** | Same as item 27-243, but 50 ton Capacity. | Each | 6331136 |
| 27-253 | Same as item 27-243, but 55 ton Capacity. | Each | 6773497 |
| **27-254** | Same as item 27-243, but 60 ton Capacity. | Each | 7204633 |
| 27-255 | Supply, installation, testing and commissioning of air cooled condensing unit (CU}, direct expansion (Dx) type, of **Asian origin** with power supply of 400V, 3ph, 50HZs with all necessary controls and compressor scroll type, semi hermetic, of 5 ton capacity, complete in all respect. | Each | 624000 |
| 27-256 | Same as item 27-255, but 10 ton Capacity. | Each | 936000 |
| 27-257 | Same as item 27-255, but 15 ton Capacity. | Each | 1560000 |
| 27-258 | Same as itt3m 27-255, but 20 ton Capacity. | Each | 2028000 |
| 27-259 | Same as item 27-255, but 25 ton Capacity. | Each | 2340000 |
| 27-260 | Same as it m 27-255, but 30 ton Capacity. | Each | 3120000 |
| 27-261 | Same as item 27-255, but 35 ton Capacity. | Each | 3510000 |
| 27-262 | Same as item 27-255, but 40 ton Capacity. | Each | 3900000 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-263 | Same as item 27-255, but 45 ton Capacity. | Each | 4680000 |
| 27-264 | Same as item 27-255, but 50 ton Capacity. | Each | 5460000 |
| 27-265 | Same as item 27-255, but 55 ton Capacity. | Each | 5570000 |
| 27-266 | Same as item 27-255, but 60 ton Capacity. | Each | 6240000 |
| 27-267 | Same as item 27-243 to 27-246 or 27-255 to 27-258, but fixing only. | Each | 15000 |
| 27-268 | Same as item 27-247 to 27-250 or 27-259 to 27-262, but fixing only. | Each | 30000 |
| 27-269 | Same as item 27-251 to 27-254 or 27-263 to 27-266, but fixing only. | Each | 45000 |
| 27-270 | Add to item 27-243 to 27-246, 27-255 to 27-258 or 27-267, if removal only. | Each | 7500 |
| 27-271 | Add to item 27-247 to 27-250, 27-259 to 27-262 or 27-268, if removal only. | Each | 15000 |
| 27-272 | Add to item 27-251 to 27-254, 27-263 to 27-266 or 27-269, if removal only. | Each | 22566 |
| 27-273 | Supply, installation, testing and commissioning of DCs Inverter type ACs split unit, heat and cool consisting of indoor units, (wall mounted type), outdoor unit including, copper tubing with proper insulation and condensate drain pipe, electric connection from indoor unit to outdoor unit, complete in all respect with wireless remote control, 1 ton capacity. | Each | 144000 |
| 27-274 | Same as item 27-273, but 1.5 ton Capacity. | Each | 228000 |
| 27-275 | Same as item 27-273, but 2.5 ton Capacity. | Each | 450000 |
| 27-276 | Same as item 27-273, but Cassette type 4 way indoor unit 1.5 ton Capacity. | Each | 265500 |
| 27-277 | Same as item 27-276, but 2 ton Capacity. | Each | 354000 |
| 27-278 | Same as item 27-276, butt 3 ton Capacity. | Each | 564000 |
| 27-279 | Same as item 27-276, butt 4 ton Capacity. | Each | 642000 |
| 27-280 | Same as item 27-273 to 27-275, but fixing only. | Each | 3000 |
| 27-281 | Same as item 27-276 to 27-279, but fixing only. | Each | 4500 |
| 27-282 | Add to item 27-273 to 27-275 or 27-280, if removal only. | Each | 1500 |
| 27-283 | Add to item 27-276 to 27-279 or 27-281, if removal only. | Each | 2250 |
| | **Air Cooled Chillers System** | | |
| 27-284 | Supply, installation testing and commissioning of complete air cooled chiller system with outdoor air cooled Chillers, chilled water piping network with proper insulation and controls, water pumping sets, Air handing units, G.I insulated ducts with air flow control devices, humidifier, air and water filters, controls with safeties, air exhaust system, fan coil units etc complete in all respect as per drawing and specification. | Ton | 240000 |
| | **Water Cooled Chillers System** | | |
| 27-285 | Supply, installation, testing and comm1ss1ornng of water cooled system, with water cooled Chiller, air handling units, chilled water piping with proper insulation and control network, air control devices, fan coil units, air exhaust system, water pumping sets, cooling tower with piping-- and electric connection network, humidifier, air & water filters and controls with safeties etc complete in all respect as per drawings and specification. | Ton | 280000 |
| | **Hot Water System for Heating** | | |
| 27-286 | Supply, installation, testing and commissioning of hot water system, including hot water generator, operated at natural gas or oil, hot water piping network with insulation, with all control and | Ton | 290000 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | safeties, electrical connection etc. complete in all respect as per drawings and specification. | | |
| | **Passengers / Cargo Lifts / Elevators** | | |
| 27-287 | **Supply, installation, testing & commissioning** of passengers / cargo lift with motor 415V, 3ph, AC, 50Hzs supply, suitable to serve 07 floors, with AC Variable Voltage & Variable Frequency drive (WVF) complete with all standard accessories, for upto 630 Kg, including all applicable safeties complete in all respect as per drawing and specification, as latest edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. EU origin. | Each | 7500000 |
| 27-288 | **Supply, installatior-, testing & commissioning** of passengers / cargo lift with motor 415V, 3 phase, AC, 50 Hzs, supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (WVF) complete with all standard accessories, upto 800 Kg, including all applicable safeties complete in all respect as per drawing and specification, as latest edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. EU origin. | Each | 9700000 |
| 27-289 | **Supply, installation, testing & commissioning** of passengers / cargo lift with motor 415 volts, 3ph, AC, 50Hzs supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (VVVF) complete with all standard accessories, upto 1000 Kg, including all applicable safeties complete in all respect as per drawing and specification. As latest .edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. EU origin. | Each | 10200000 |
| 27-290 | **Supply, installation, testing & commissioning** of passengers / cargo lift with motor 415 V, 3 phase, AC, 50Hzs supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (VWF) complete with all standard accessories, for upto 1600 Kg, including all applicable safeties complete in all respect as per drawing and specification. As latest edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. EU origin. | Each | 16300000 |
| | **Passengers/ Cargo Lifts/ Elevators (Asian Origin)** | | |
| 27-291 | **Supply, installation, testing & commissioning** of passengers / cargo lift with motor 415 V, 3ph, AC, 50Hzs supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (WVF drive) complete with all standard accessories, for upto 630 Kg, including all applicable safeties complete in all respect as per drawing and specification. As latest edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. Asian origin. | Each | 5100000 |
| 27-292 | Passengers / cargo lift with motor 415 V, 3ph, AC 50Hzs supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (VWF drive) complete with all standard accessories, for upto 800 Kg, including all applicable safeties complete in all respect as per drawing and specification. As latest edition of applicable standards of ANSI; •ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. Asian origin. | Each | 5200000 |
| 27-293 | Passengers / cargo lift with motor 415 V, 3ph, AC, 50Hzs supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (WVF) complete with all standard accessories, for upto 1000 Kg, including all applicable safeties complete in all respect as per drawing and specification. As latest edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM, NEMA and IEE etc. Asian origin. | Each | 5300000 |

| j Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-294 | Passengers / cargo lift with motor 415 V, 3ph, AC, 50Hzs supply, suitable to serve 07 floors with AC Variable Voltage & Variable Frequency drive (VVVF) complete with all standard accessories, for upto 1600 Kg, including all applicable safeties complete in all respect as per drawing and specification. As latest edition of applicable standards of ANSI, ASME, BS/EN, AWS, NFPA, ASTM,NEMA and IEE etc. Asian origin. | Each | 6000000 |
| 27-295 | Servicing / Maintenance / Monthly inspection as per OEM standard of Elevators, all as specified. | One Job | 15000 |
| | **GANTRY EOT CRANES** | | |
| 27-296 | Supply, fixing, Testing and Commissioning of EQT Crane, span 12 metre, Bay length 15.2 metre, Height of lift 7.76 metre capacity 5 Tonne single girder, including cabals, Control Panels and EQT kit suitable operation on 410/220 Volts, 3 Phase with NL, complete in all respect as per drawings and specification. | Each | 11225000 |
| 27-297 | Same as Item 27-296, but Capacity 7.50 Tonne Single girder. | Each | 12000000 |
| 27-298 | Same as Item 27-296, but Capacity 10.00 Tonne Double girder. | Each | 13554910 |
| 27-299 | Same as Item 27-296, but Capacity 15.00 Tonne Double girder. | Each | 16400000 |
| 27-300 | Same as Item 27-296, but Capacity 20.00 Tonne Double girder. | Each | 18600000 |
| 27-301 | Same as Item 27-296, but Capacity 25.00 Tonne Double girder. | Each | 20060000 |
| 27-302 | Same as Item 27-296, but Capacity 30.00 Tonne Double girder. | Each | 27900000 |
| 27-303 | Same as Item 27-296, but Capacity 35.00 Tonne Double girder. | Each | 28800000 |
| 27-304 | Same as Item 27-296, but Capacity 5.00 Tonne single girder, span 20.00 metre, bay length 15.20 metre. | Each | 11725000 |
| 27-305 | Same as Item 27-304, but Capacity 7.50 Tonne single girder, span 20.00 metre, bay length 15.20 metre. | Each | 12500000 |
| 27-306 | Same as Item 27-304, but Capacity 10.00 Tonne double girder, span 20.00 metre, bay length 15.20 metre. | Each | 14154910 |
| 27-307 | Same as Item 27-304, but Capacity 15.00 Tonne double girder, span 20.00 metre, bay length 15.20 metre. | Each | 17400000 |
| 27-308 | Same as Item 27-304, but Capacity 20.00 Tonne double girder, span 20.00 metre, bay length 15.20 metre. | Each | 19800000 |
| 27-309 | Same as Item 27-304, but Capacity 25.00 Tonne double, span 20.00 metre, bay length 15.20 metre. | Each | 21600000 |
| 27-310 | Same as Item 27-304, but Capacity 30.00 Tonne double girder, span 20.00 metre, bay length 15.20 metre. | Each | 29800000 |
| 27-311 | Same as Item 27-304, but Capacity 35.00 Tonne double girder, span 20.00 metre, bay length 15.20 metre. | Each | 30800000 |
| | **Explosion Proof EOT Cranes** | | |
| 27-312 | Supply, fixing, Testing and Commissioning of Explosion proof EQT Crane, span 5 metre, bay length 5 metre, height of lift 5 metre, capacity 2 Tonne, double girder, including Cables, Control Panels and EQT kit suitable operation on 410/220V, 3Ph with NL. Complete in all respect as per drawings and specification. | Each | 33500000 |
| **27-31l** | Same as Item 27-312, but 5 Tonne capacity, span 12 Metre, bay length 30 metre, lift of height 8 metre, single girder. | Each | 14905000 |
| 27-3-14 | Same as Item 27-312, but 15 Tonne Capacity, Span14 Metre, bay length 20.42 metre, lift of height 9.1 metre, double girder. | Each | 54093531 |
| | **Standard Manual Cranes** | | |
| 27-315 | Supply, fixing, Testing and Commissioning of all motion manual control crane, span 16 metre, bay length 30 metre, Height of lift 4.3 metre, capacity 3 Tonne single girder, complete in all respect as per drawings and specification. | Each | 3600000 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-316 | Same as Item 27-315, but 3 Tonne capacity, span 12 Metre, bay length 20 metre, lift of height 4.3 metre. | Each | 3227566 |
| 27-317 | Same as Item 27-315, but 3 Tonne capacity, span 9 Metre, bay length 12 metre, lift of height 4.3 metre. | Each | 2945318 |
| 27-318 | Same as Item 27-315, but 3 Tonne capacity, span 14 Metre, bay length 16 metre, lift of height 4.5 metre. | Each | 2900000 |
| | **Manual Cranes Ex Class** | | |
| 27-319 | Supply, fixing, Testing and Commissioning of All motion manual control Ex class crane, span 4 metre, bay length 24 metre, height of lift 3.0 metre, capacity 3 Tonne single girder, complete in all respect as per drawings and specification. | Each | 6200000 |
| | **Generator Set** | | |
| 27-320 | Supply, installation, testing and commissioning of Diesel Engine Prime rating Generator in accordance with ISO-3046, ISO-9001:2015, BS-5514, DIN-6271, AS-2789, 2014/3/EU electromagnetic compatibility and 2000/14/EC, noise emission for outdoor use. Engine and alternator mounted on robust skid frame including fuel tank, control panel, diesel engine four stroke, water cooled 1500 RPM, built in battery charger, batteries and brushless self-excited alternator, 400/230V, 3 phase and NL, 50 Hz, power factor 0.8, with ATS panels but without canopy, (CBU) complete assembled, integrated/manufactured in EU, UK & USA 09 KVA. | Each | 1467270 |
| 27-321 | Same as item 27-320, but 14 KVA. | Each | 1619370 |
| 27-322 | Same as item 27-320, but 20 KVA. | Each | 2047220 |
| 27 J23 | Same as item 27-320, but 30 KVA. | Each | 2122900 |
| 27-324 | Same as item 27-320, but 40 KVA. | Each | 2284390 |
| 27-325 | Same as item 27-320, but 60 KVA. | Each | 2857690 |
| 27-326 | Same as item 27-320, but 80 KVA. | Each | 2916250 |
| 27-327 | Same as item 27-320, but 100 KVA. | Each | 3167800 |
| 27-328 | Same as item 27-320, but 120 KVA. | Each. | 3635800 |
| 27-329 | Same as item 27-320, but 150 KVA. | Each | 4349000 |
| 27-330 | Same as item 27-320, but 180 KVA. | Each | 5109500 |
| 27-331 | Same as item 27-320, but 200 KVA. | Each | 5628300 |
| 27-332 | Same as item 27-320, but 250 KVA. | Each | 7294000 |
| 27-333 | Same as item 27-320, but 300 KVA. | Each | 8906100 |
| 27-334 | Same as item 27-320, but 350 KVA. | Each | 9573000 |
| 27-335 | Same as item 27-320, but 380 KVA. | Each | 10755267 |
| 27-336 | Same as item 27-320, but 400 KVA. | Each | 11037000 |
| 27-337 | Same as item 27-320, but 450 KVA. | Each | 11534250 |
| 27-338 | Same as item 27-320, but 500 KVA. | Each | 14168000 |
| 27-339 | Same as item 27-320, but 590 KVA. | Each | 16040000 |
| 27-340 | Same as item 27-320, but 650 KVA. | Each | 18380000 |
| 27-341 | Same as item 27-320, but 700 KVA. | Each | 27155000 |
| 27-342 | Same as item 27-320, but 800 KVA. | Each | 28442000 |
| 27-343 | Same as item 27-320, but 1000 KVA. | Each | 32069000 |
| 27-344 | Same as item 27-320, but 1250 KVA. | Each | 41110000 |
| 27-345 | Supply, installation, testing and commissioning of Diesel Engine Prime rating Generator in accordance with ISO-3046, ISO-9001:2015, BS-5514, DIN-6271, AS-2789, 2014/3/EU electromagnetic compatibility and 2000/14/EC, noise emission for outdoor use. Engine and alternator mounted on robust skid frame including fuel tank, control panel, diesel engine four stroke, water | Each | 1181250 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | cooled 1500 RPM, built in battery charger, batteries and brushless self-excited alternator, 400/230 volt 3 phase and NL, 50Hzs power factor 0.8, and ATS panel, without canopy, locally assembled, manufactured in EU, UK & USA 15 KVA. | | |
| 27-346 | Same as item 27-345, but 20 KVA. | Each | 1393750 |
| 27-347 | Same as item 27-345, but 30 KVA. | Each | 1668750 |
| 27-348 | Same as item 27-345, but 45 KVA. | Each | 1912500 |
| 27-349 | Same as item 27-345, but 60 KVA. | Each | 2156250 |
| 27-350 | Same as item 27-345, but 80 KVA. | Each | 2656250 |
| 27-351 | Same as item 27-345, but 100 KVA. | Each | 2878750 |
| 27-352 | Same as item 27-345, but 150 KVA. | Each | 4335000 |
| 27-353 | Same as item 27-345, but 200 KVA. | Each | 5122500 |
| 27-354 | Same as item 27-345, but 250 KVA. | Each | 6560000 |
| 27-355 | Same as item 27-345, but 300 KVA. | Each | 8360000 |
| 27-356 | Same as item 27-345, but 350 KVA. | Each | 8735000 |
| 27-357 | Same as item 27-345, but 400 KVA. | Each | 10121250 |
| 27-358 | Same as item 27-345, but 500 KVA. | Each | 12070000 |
| 27-359 | Same as item 27-345, but 650 KVA. | Each | 15315500 |
| 27-360 | Same as item 27-345, but 800 KVA. | Each | 22535000 |
| 27-361 | Same as item 27-345, but 1250 KVA. | Each | 40390000 |
| 27-362 | Same as item 27-320 to 27-324 or 27-345 to 27-348, but fixing only. | Each | 15000 |
| 27-363 | Same as item 27-325 to 27-329 or 27-349 to 27-352, but fixing only. | Each | 30000 |
| 27-364 | Same as item 27-330 to 27-334 or 27-353 to 27-356, but fixing only. | Each | 50000 |
| 27-365 | Same as item 27-335 to 27-339 or 27-357 to 27-358, but fixing only. | Each | 55000 |
| 27-366 | Same as item 27-340 to 27-344 or 27-359 to 27-361, but fixing only. | Each | 65000 |
| 27-367 | Add to item 27-320 to 27-324, 27-345 to 27-348 or 27-362, if removal only. | Each | 7500 |
| 27-368 | Add to item 27-325 to 27-329, 27-349 to 27-352 or 27-363, if removal only. | Each | 15000 |
| 27-369 | Add to item 27-330 to 27-334, 27-353 to 27-356 or 27-364, if removal only. | Each | 25146 |
| 27-370 | Add to item 27-335 to 27-339, 27-357 to 27-358 or 27-365, if removal only. | Each | 27486 |
| 27-371 | Add to item 27-340 to 27-344, 27-359 to 27-361 or 27-366, if removal only. | Each | 32500 |
| 27-372 | Supply, installation of Locally Fabricated weather and sound proof canopy, including main frame structure made of 14 SWG, epoxy painted insulation material (Glass wool), complete in all respect with noise level 84 dBA at 1 meter distance, for 15 KVA generator set. | Each | 69000 |
| 27-373 | Same as item 27-372, but 20 KVA. | Each | 80500 |
| 27-374 | Same as item 27-372, but 30 to 60 KVA. | Each | 115000 |
| 27-375 | Same as item 27-372, but 80 to 100 KVA. | Each | 149500 |
| 27-376 | Same as item 27-372, but 150 KVA. | Each | 230000 |
| 27-377 | Same as item 27-372, but 200 KVA. | Each | 253000 |
| 27-378 | Same as item 27-372, but 250 KVA. | Each | 345000 |
| 27-379 | Same as item 27-372, but 300 KVA. | Each | 402500 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 27-380 | Same as item 27-372, but 350 to 400 KVA. | Each | 488750 |
| 27-381 | Same as item 27-372, but 500 KVA. | Each | 575000 |
| 27-382 | Same as item 27-372, but 650 KVA. | Each | 747500 |
| 27-383 | Same as item 27-372, but 800 KVA. | Each | 920000 |
| 27-384 | Same as item 27-372, but 1000 KVA. | Each | 1150000 |
| 27-385 | Same as item 27-372 to 27-376, but fixing only. | Each | 6000 |
| 27-386 | Same as item 27-377 to 27-380, but fixing only. | Each | 9000 |
| 27-387 | Same as item 27-381 to 27-384, but fixing only. | Each | 15000 |
| 27-388 | Add to item 27-372 to 27-376 or 27-385, if removal only. | Each | 3000 |
| 27-389 | Add to item 27-377 to 27-380 or 27-386, if removal only. | Each | 4500 |
| 27-390 | Add to item 27-381 to 27-384 or 27-387, if removal only. | Each | 7500 |
| | **Solar Energy System** | | |
| 27-391 | Supply installation testing and commissioning of electric solar energy system, including PV modules, /PV module mounting system, sun tracking system where required, inverters, AC/DC cable network, smart energy meter, all protection and safties, earthing, lightning protection system, Electrical panels board and maintenance free batteries as per drawing and specifications. | Watt | 95 |
| | **Medical Gases - Each BED for OT** | | |
| 27-392 | Supply installation, testing commissioning, BED Head unit horizontal type, comprising of bed/reading light with on/off switch, multi pin socket, nurse call/alert button, complete electric wiring, master alarm panel, monitor shelf, air vacuum complete set along with seamless medical grade copper pipe, multiple zone valve box and cylinder type duplex air dryer & filtration system, automatic oxygen, nitrogen Manifold, Medical compressed Air Station, Flow meter with humidifier, gas outlets terminal unit, multi movement double arm, complete in all respect as per drawing specification. | Bed | Please refer to supplementary Instructions |
| | **Each BED for Ward** | | |
| 27-393 | Supply, installation, testing, commissioning, BED Head unit Horizontal type comprising of bed/reading light with on/off switch multi pin socket, nurse call/alert button, complete electric wiring, master alarm panel, monitor shelf, air vacuum complete set, along with seamless medical grade copper pipe, multiple zone valve box and cylinder type duplex air dryer & filtration system, automatic Oxygen, medical compressed air station, flow meter with humidifier, gas outlets terminal unit, multi movement, double arm, complete as per drawings/ specification. | Bed | Please refer to supplementary Instructions |
| | **Public Address System** | | |
| 27-394 | Supply & fixing of ceiling speaker, circular horn peaker power, PVC conduit polyethylene insulation tinned copper Conductor, twin core cable 1.5mm$^2$/450/0.2mm, power amplifier cabinet, handheld microphone set corded Wireless hand held microphone blue tooth complete in all respect of approved quality. (Covered Area Rate (i.e. Rates/ Sft), complete as per drawings/ specification. | Sqm | Please refer to supplementary Instructions |
| 27-395 | **Fire Extinguishing and Suppression System** | | |
| | Supply, fixing, testing, commissioning of IP addressable fire detection and alarm system comprising of smoke detector, heat detector, multi detector, manual call point (break glass type) electronic sounder with LED flushing light, IP addressable fire alarm control panel along with input and output module low smoke electric wiring with FR cable in PVC conduct all as specified (covered Area Rate i.e Rate/Sqft), complete as per drawings / specification. | Sqm | Please refer to supplementary Instructions |

# SECTION - 28

# MATERIAL SUPPLY ONLY RATES

# (BUILDING, ROADS AND RUNWAYS)

# RECORD OF AMENDMENTS

| `SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION 28
## MATERIALS SUPPLY ONLY RATES

### BUILDINGS, ROADS AND RUNWAYS ETC.

The rates for materials given below have been used in compiling the item rates in this schedule and the same will be used as defined in General Rules. In case where MES Stores are issued to the contractors under various contracts on payment, the recovery will be affected at these rates as given in General Rules.

| SI NO | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-1 | Acrylic based rubberized liquid membrane. | Sqm | 453 |
| 28-2 | Admixture for Concrete. | Ltr | 365 |
| 28-3 | Alpha / Rim Lock, Standard Quality. | Each | 886 |
| 28-4 | Alpha/ Rim Lock, Deluxe Quality. | Each | 1288 |
| 28-5 | Alpha/ Rim Lock, Premium Quality. | Each | 2184 |
| 28-6 | Aluminium Door Handle, Deluxe Quality. | Each | 221 |
| 28-7 | Aluminium Fly/ Insect Screening, Deluxe and Premium Quality. | Sqm | 4304 |
| 28-8 | Aluminium Steel Sheet, 18 B.G. | Kg | 856 |
| 28-9 | Aluminium Steel Sheet, 20 B.G. | Kg | 453 |
| 28-10 | Aluminium strip, 100 mm wide. | Mtr | 197 |
| 28-11 | Aluminium stud, flush type 10 cm x 20 cm x 2 cm. | Each | 640 |
| 28-12 | Anti-static tiles, 3 mm thick, 300 x 300 mm. | Sqm | 1949 |
| 28-13 | Ash Wood. | Cum | 206068 |
| 28-14 | Basin Mixer, Standard Quality. | Each | 4500 |
| 28-15 | Basin Mixer, Deluxe Quality. | Each | 6420 |
| 28-16 | Basin Mixer, Premium Quality. | Each | 9500 |
| 28-17 | Bath Cabinet. | Each | 2767 |
| 28-18 | Bath curtain, (1.78 x 1.78m). | Each | 755 |
| 28-19 | Bib cock, CP. | Each | 842 |
| 28-20 | Bitumen felt, Two Ply. | Sqm | 211 |
| 28-21 | Asphalt cement, grade 10-20. | Tonne | 117000 |
| 28-22 | Asphalt cement, grade 60-70 / 80-100. | Tonne | 91000 |
| 28-23 | Bitumen washer. | Each | 8 |
| 28-24 | Binding wire 14- 18 SWG. | Ton | 129000 |
| 28-25 | Bolt Kit. | Each | 151 |
| 28-26 | Bolts 10 mm dia length not exceeding 75 mm. | Each | 20 |
| 28-27 | Bolts 10 mm dia length exceeding 75 mm but not exceeding 150 mm. | Each | 25 |
| 28-28 | Bolts 10 mm dia length exceeding 150 mm but not exceeding 300 mm. | Each | 60 |
| 28-29 | Bolts 10 mm to 18 mm dia length not exceeding 75 mm. | Each | 59 |
| 28-30 | Bolts 1O mm to 18 mm dia length exceeding 75 mm but not exceeding 150 mm. | Each | 64 |
| 28-31 | Bolts 10 mm to 18 mm dia length exceeding 150 mm but not exceeding 300 mm. | Each | 89 |
| 28-32 | Bolts 18 mm to 25 mm dia, length not exceeding 75 mm. | Each | 101 |
| 28-33 | Bolts 18 mm to 25 mm dia, length exceeding 75 mm but not exceeding 150 mm. | Each | 171 |
| 28-34 | Bolts 18 mm to 25 mm dia, length exceeding 150 mm but not exceeding 300 mm. | Each | 221 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-35 | Bottle trap. | Each | 1308 |
| 28-36 | Boulders, for retaining wall. | Cum | 1295 |
| 28-37 | Bracket for sink. | Pair | 302 |
| 28-38 | Brick tiles, 300 x 150 x 38 mm. | M.Nos | 16000 |
| 28-39 | Brick tiles, 300 x 150 x 50 mm. | M.Nos | 20000 |
| 28-40 | Bricks, burnt 1st class. | M.Nos | 12000 |
| 28-41 | Brick Bat. | Each | 6 |
| 28-42 | Brush/ Tumbler holder (Plastic). | Each | 433 |
| 28-43 | Building paper. | Sqm | 39 |
| 28-44 | Carpet Tiles Fixed with Glue. | Sqm | 2544 |
| 28-45 | Casted grating 100 mm x 100 mm. | Each | 392 |
| 28-46 | Casted grating 150 mm x 150 mm. | Each | 554 |
| 28-47 | Cement - Sulphate Resisting (50 Kg packing). | Bag | 540 |
| 28-48 | Cement, Ordinary (50 Kg packing). | Bag | 515 |
| 28-49 | Cement, white / coloured (40 Kg packing). | Bag | 1340 |
| 28-50 | Chipboard, 13 mm thick. | Sqm | 395 |
| 28-51 | Chipboard, 19 mm thick. | Sqm | 454 |
| 28-52 | Chipboard, 25 mm thick. | Sqm | 622 |
| 28-53 | Chip Board Veneered, 19 mm thick | Sqm | 824 |
| 28-54 | Chopped straw (Bhoosa). | Kg | 17 |
| 28-55 | CI Floor Trap including Reducer. | Each | 1711 |
| 28-56 | Cistern flushing with fittings. | Each | 1811 |
| 28-57 | Cistern Low Down Glazed. | Each | 2515 |
| 28-58 | Screw Brass 150 mm. | Each | 18 |
| 28-59 | Closet Pan in any Colour. | Each | 2516 |
| 28-60 | Commercial Ply 3 mm. | Sqm | 366 |
| 28-61 | Concertina / Razor wire 12 SWG, loop dia 0.450 to 0.991 M. | Metre | 396 |
| 28-62 | Connection Brass 15 mm dia. | Each | 181 |
| 28-63 | Copper float valve 20 mm dia. | Each | 383 |
| 28-64 | Copper sheet 24 gauge. | Sqm | 5380 |
| 28-65 | Copper sheet 26 gauge. | Sqm | 4304 |
| 28-66 | Corner Shelf in any size and Shape. | Each | 1610 |
| 28-67 | Cover Strip Aluminium, 60 mm wide and 2 mm thick. | Meter | 230 |
| 28-68 | Cover Strip Aluminium, 60 mm wide and 2 mm thick in sections. | Meter | 459 |
| 28-69 | Crushed Aggregates with maximum nominal size of 100 mm graded. | Cum | 1410 |
| 28-70 | Crushed Aggregates with maximum nominal size of 13 mm to 19 mm graded. | Cum | 1-589 |
| 28-71 | Crushed Aggregates with maximum nominal size of 25 mm to 38 mm graded | Cum | 1518 |
| 28-72 | Crushed Aggregates with maximum nominal size of 3 mm graded. | Cum | 1510 |
| 28-73 | Crushed Aggregate with maximum nominal size of 3 mm to 6 mm graded. | Cum | 1530 |
| 28-74 | Crushed Aggregate with maximum nominal size of 50 mm graded | Cum | 1490 |
| 28-75 | Crushed Aggregate with maximum nominal size of 63 mm graded. | Cum | 1440 |
| 28-76 | Crushed Aggregate with maximum nominal size of 75 mm graded. | Cum | 1236 |
| 28-77 | Deformed Bar, Grade 40. | Tonne | 111000 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-78 | Deformed Bar, Grade 60. | Tonne | 113000 |
| 28-79 | Crystalline water proofing Admixture. | Kg | 800 |
| 28-80 | Crystalline water proofing coating. | Sqm | 160 |
| 28-81 | Door Closer Aluminium, single action, Deluxe Quality. | Each | 1610 |
| **28-82** | Door Closer Aluminium, single action, Premium Quality. | Each | 1912 |
| 28-83 | Door Closer Aluminium, Double action. | Each | 9559 |
| 28-84 | Double Bib Cock, Standard Quality. | Each | 2211 |
| 28-85 | Double Bib Cock, Deluxe Quality. | Each | 3702 |
| 28-86 | Double Bib Cock, Premium Quality. | Each | 4400 |
| 28-87 | Dry bond | Kg | 12 |
| 28-88 | Expansion cap, 25 mm to 40 mm dia (Plastic). | Each | 200 |
| 28-89 | Expanded Metal (XPM), 25 mm x 25 mm x 2 mm, 16 gauge. | Sqm | 411 |
| 28-90 | Expanded Metal (XPM), 38m mx.44 mm x 2 mm, 18 gauge. | Sqm | 217 |
| 28-91 | Expanded Metal (XPM), 38 mm x 44 mm x 2 mm, 16 gauge. | Sqm | 281 |
| 28-92 | Expanded Metal (XPM), 25 mm x 25 mm x 2 mm, 18 gauge. | Sqm | 325 |
| 28-93 | Facing Stone, 300 x 150 x 10 mm. | Sqm | 596 |
| 28-94 | Fiber Glass Sheets, 1 mm thick. | Sqm | 703 |
| 28-95 | Fiber Glass Sheets, 2 mm thick. | Sqm | 1624 |
| 28-96 | Fiber Glass Sheets, 3 mm thick. | Sqm | 2260 |
| 28-97 | Fiber Washer. | Each | 5 |
| 28-98 | Fire wood. | Kg | 19 |
| 28-99 | Fillet Soft wood. | Meter | 89 |
| 28-100 | Flush Connection PVC. | Each | 151 |
| 28-101 | Flush Pipe Plastic long type. | Each | 201 |
| 28-102 | Flush tank Concealed type. | Each | 17237 |
| 28-103 | Frosted Paper. | Sqm | 1083 |
| 28-104 | GI Barbed wire, 12 SWG. | Metre | 33 |
| 28-105 | GI Barbed wire, 14 SWG. | Meter | 19 |
| 28-106 | Glass Sheet, 3 mm thick. | Sqm | 693 |
| 28-107 | Glass Sheet, 10 mm thick. | Sqm | 2328 |
| 28-108 | Glass Sheet, 12 mm thick. | Sqm | 2652 |
| 28-109 | Glass Sheet, 5 mm thick. | Sqm | 996 |
| 28-110 | Glass Sheet, 8 mm thick. | Sqm | 1678 |
| 28-111 | Glass Sheet frosted, 3 mm thick. | Sqm | **823** |
| 28-112 | Glass Sheet frosted, 5 mm thick. | Sqm | 1115 |
| 28-113 | Glass Sheet milky, 5 mm thick. | Sqm | 1429 |
| 28-114 | Glass Sheet tinted, (Double Glazing) 5 mm thick. | Sqm | 1305 |
| 28-115 | Glass Sheet tinted, 5 mm thick. | Sqm | 1115 |
| 28-116 | Glass Sheet tinted, 8 mm thick. | Sqm | 2761 |
| 28-117 | Glass Tempered of any thickness. | Sqm | 1624 |
| 28-118 | Glue. | Kg | 200 |
| 28-119 | Granular sub base. | Cum | 1412 |
| 28-120 | Gutka tiles of different Sizes. | Sqm | 909 |
| 28-121 | Gypsum Sheet decorative 1200 mm x 2400 mm x 12.50 mm thick with Aluminium Tee/ Angle 25 mm x 25 mm x 1 mm. | Sqm | 900 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-122 | 1st Class Hard Wood Sheesham. | Cum | 123585 |
| 28-123 | Hand Shower, Standard Quality. | Each | 1500 |
| 28-124 | Hand Shower, Deluxe Quality. | Each | 2500 |
| 28-125 | Hand Shower, Premium Quality. | Each | 3100 |
| 28-126 | Head, Standard Quality. | Each | 400 |
| 28-127 | Head, Deluxe Quality. | Each | 660 |
| 28-128 | Head, Premium Quality. | Each | 900 |
| 28-129 | High Tensile carbon steel wire. | Kg | 231 |
| 28-130 | Hydraulic Door Closer. | Each | 1862 |
| 28-131 | Hydraulic seat Cover. | Each | 2700 |
| 28-132 | Kerb stone 300 mm x 300 mm x 150 mm. | Each | 100 |
| 28-133 | Kerb stone 350 mm x 300 mm x 150 mm. | Each | 120 |
| 28-134 | Kerb stone 450 mm x 300 mm x 150 mm. | Each | 150 |
| 28-135 | L hook 10 mm dia for roof. | Each | 25 |
| 28-136 | Lacquer Polish. | Ltr | 604 |
| 28-137 | Latch CP 150 mm. | Each | 503 |
| 28-138 | Lime un-slaked. | Kg | 14 |
| 28-139 | Limpet washers. | Each | 6 |
| 28-140 | Malaysian Ply Wood 3 mm. | Sqm | 366 |
| 28-141 | 1st Class hard wood Mahogany. | Cum | 202515 |
| 28-142 | MDF Laminated Sheet, 10 mm thick. | Sqm | 588 |
| 28-143 | MDF Laminated Sheet, 16 mm thick. | Sqm | 891 |
| 28-144 | MDF Laminated Sheet, 24 mm thick. | Sqm | 1496 |
| 28-145 | Mineral Acoustic Sheet ceiling 600 x 600 x 12 mm. | Sqm | 1570 |
| 28-146 | Mirror 5 mm thick any shape. | Sqm | 1056 |
| 28-147 | Mirror 5 mm thick. | Each | 604 |
| 28-148 | Marble Patty 8 to 10 mm thick and 40 mm wide | Meter | 27 |
| 28-149 | MS Hollow Pipe 1 ½" x 1 ½", Square 16 gauge. | Meter | 246 |
| 28-150 | MS Hollow Pipe 1 ½" x 1 ½", Square 18 gauge. | Meter | 191 |
| 28-151 | MS Hollow Pipe 1 ½" x 1", Rectangular 16 gauge. | Meter | 213 |
| 28-152 | MS Hollow Pipe 1 ½" x 1", Rectangular 18 gauge. | Meter | 164 |
| 28-153 | MS Hollow Pipe 1 ¼" x 1 ¼", Square 16 gauge. | Meter | 197 |
| 28-154 | MS Hollow Pipe 1 ¼" x 1 ¼", Square 18 gauge. | Meter | 149 |
| 28-155 | MS Hollow Pipe 1" x 1", Square 16 gauge. | Meter | 126 |
| 28-156 | MS Hollow Pipe 1" x 1", Square 18 gauge. | Meter | 123 |
| 28-157 | MS Hollow Pipe 2" x 1 ½", Rectangular 18 gauge. | Meter | 228 |
| 28-158 | MS Hollow Pipe 2" x ½", Square 16 gauge. | Meter | 305 |
| 28-159 | MS Hollow Pipe 2" x 2", Square 16 gauge. | Meter | 300 |
| 28-160 | MS Hollow Pipe 2" x 2", Square 18 gauge. | Meter | 228 |
| 28-161 | MS Hollow Pipe 3" x 3", Square 16 gauge. | Meter | 585 |
| 28-162 | MS Hollow Pipe 3" x 3", Square 18 gauge. | Meter | 446 |
| 28-163 | Nail Galvanised. | kg | 352 |
| 28-164 | Nail wire. | kg | 252 |
| 28-165 | P or S Trap. | Each | 191 |
| 28-166 | P.V.C Waste Pipe. | Each | 71 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-167 | Paint Camouflaging. | Ltr | 387 |
| 28-168 | Paint Road Marking. | Ltr | 406 |
| 28-169 | Paint Synthetic Enamel. | Ltr | 320 |
| 28-170 | Paint Weather resistant. | Ltr | 516 |
| 28-171 | Paint Aluminium. | Lit | 387 |
| 28-172 | Paving Stone Natural colour, 50 mm thick. | Sqm | 426 |
| 28-173 | Paving Stone any Colour, 50 mm thick. | Sqm | 455 |
| 28-174 | Paving Stone Natural Colour, 60 mm thick. | Sqm | 465 |
| 28-175 | Paving Stone any Colour, 60 mm thick. | Sqm | 488 |
| 28-176 | Paving Stone Natural Colour, 80 mm Thick. | Sqm | 630 |
| 28-177 | Paving Stone, any Colour, 80 mm thick. | Sqm | 667 |
| 28-178 | PCC hollow block (0.400 x 0.200 x 0.150 Mtr) Load Bearing. | Each | 67 |
| 28-179 | PCC solid block (0.300 x 0.200 x 0.150 Mtr) Load Bearing. | Each | 50 |
| 28-180 | PCC solid block (0.300 x 0.200 x 0.150 Mtr) Non Load Bearing. | Each | 44 |
| 28-181 | PCC hollow block (0.400 x 0.200 x 0.150 Mtr) Non Load Bearing. | Each | 59 |
| 28-182 | Pedestal any Colour. | Each | 1660 |
| 28-183 | Pillar cock, CP. | Each | 1351 |
| 28-184 | Plastic Bath Cabinet, 450 mm x 450 mm x 100 mm. | Each | 2767 |
| 28-185 | Plastic Connection, 15 mm-Plastic union both end. | Each | 141 |
| 28-186 | Plastic connection, 20 mm dia Brass. | Each | 222 |
| 28-187 | Plastic Emulsion. | Lit | 299 |
| 28-188 | Plastic float valve, 15 mm dia. | Each | 252 |
| 28-189 | Plastic shelf. | Each | 503 |
| 28-190 | Plastic stud with reflector, 10 cm x 20 cm x 2 cm (Flush type). | Each | 550 |
| 28-191 | Plastic stud with reflector, 10 cm x 7.5 cm x 2 cm (Raised type). | Each | 330 |
| 28-192 | Ply Wood 3 mm. | Sqm | 366 |
| 28-193 | Poly extruded board 50 mm thick density 32-35 kg/$m^3$. | Sqm | 833 |
| 28-194 | Polyvinyl Distemper. | Kg | 111 |
| 28-195 | Polythene sheet. | Sqm | 340 |
| 28-196 | Push Plate CP. | Each | 251 |
| 28-197 | Push Plate Brass. | Each | 402 |
| 28-198 | POP Tiles (600 x 600 x 20 mm) (any Design). | Sqm | 574 |
| 28-199 | PVC SC twin Hollow or Single Hollow corrugated sheet/ roofing coated weighing not less than 5.38 Kg / Sqm except framing all as specified. | Sqm | 2313.4 |
| 28-200 | PVC SC twin Hollow or Single Hollow corrugated sheet/ roofing coated weighing not less than 4.842 Kg / Sqm except framing all as specified. | Sqm | 3766 |
| 28-201 | PVC floor plain Tiles, 5 mm thick. | Sqm | 1840 |
| 28-202 | PVC floor plain Tiles, 3 mm thick. | Sqm | 1029 |
| 28-203 | PVC floor plain Tiles, 2 mm thick. | Sqm | 758 |
| 28-204 | PVC floor plain Sheet, 3 mm thick. | Sqm | 1711 |
| 28-205 | PVC floor plain Sheet, 2 mm thick. | Sqm | 1157 |
| 28-206 | PVC plain sheet, 2 mm thick embedded except framing. | Sqm | 1818.44 |
| 28-207 | PVC Sheet 1.5 Fibre Glass Ceiling/ Panelling, 1200 mm x 600 mm. | Sqm | 1689 |
| 28-208 | Quick Rubber Based Runway Marking Paint. | Ltr | 453 |
| 28-209 | Rawal plug with screw. | Each | 7 |

| Sl No | Description | Unit | Rate {Rs) |
|---|---|---|---|
| **28-210** | Rubber ring uPVC soil and waste pipe, 50 mm. | Each | 40 |
| **28-211** | Rubber ring uPVC soil and waste pipe, 75 mm. | Each | **62** |
| **28-212** | Rubber ring uPVC soil and waste pipe, 110 mm. | Each | **94** |
| **28-213** | Rubber ring uPVC soil and waste pipe, 160 mm. | Each | **137** |
| **28-214** | Rubber ring Gasket, 300 mm. | Each | **38** |
| **28-215** | Rubber ring Gasket, 375 mm. | Each | **48** |
| **28-216** | Rubber ring Gasket, 450 mm. | Each | **53** |
| **28-217** | Rubber ring Gasket, 525 mm. | Each | **57** |
| **28-218** | Rubber ring Gasket, 600 mm. | Each | **57** |
| **28-219** | Rubber ring Gasket, 675 mm. | Each | 60 |
| **28-220** | Rubber ring Gasket, 750 mm. | Each | 60 |
| **28-221** | Rubber ring Gasket, 825 mm. | Each | 60 |
| **28-222** | Rubber ring Gasket, 900 mm. | Each | **65** |
| **28-223** | Rubber ring Gasket, 1050 mm. | Each | **65** |
| **28-224** | Rubber ring Gasket, 1200 mm. | Each | **72** |
| **28-225** | Sand (washed). | Cum | 890 |
| **28-226** | Sheesham Ply, 3 mm. | Sqm | **379** |
| **28-227** | Soft Board. | Sqm | **465** |
| **28-228** | Shower Rose, CP. | Each | 604 |
| **28-229** | Single Lever Basin Mixer, Standard Quality. | Each | **4732** |
| **28-230** | Single Lever Basin Mixer, Deluxe Quality. | Each | **5685** |
| **28-231** | Single Lever Basin Mixer, Premium Quality. | Each | **7996** |
| **28-232** | Sink Mixer, Standard Quality. | Each | **6200** |
| **28-233** | Sink Mixer, Deluxe Quality. | Each | **9460** |
| **28-234** | Sink Mixer, Premium Quality. | Each | **14558** |
| **28-235** | Sink Scullery of Stainless Steel with Double Drainage Board with Single Bowl upto 6000 Sqcm. | Each | 8351 |
| **28-236** | Sink Scullery of Stainless Steel with Single Drainage Board upto 6000 Sqcm. | Each | 5061 |
| **28-237** | Sink Scullery of Stainless Steel with Single Drainage Board with Double Bowl exceeding 6000 Sqcm upto 7500 Sqcm. | Each | **6037** |
| **28-238** | Sink Stainless Steel with Double Drainage Board and Double Bowl exceeding 6000 Sqcm upto 9300 Sqcm. | Each | 9861 |
| **28-239** | Sink waste coupling. | Each | **252** |
| **28-240** | Sliding Bolt (Brass), 300 mm long. | Each | 1207 |
| **28-241** | Sliding Bolt (Brass), 450 mm long. | Each | 1590 |
| **28-242** | Sliding Bolt (CP), 300 mm long. | Each | **322** |
| **28-243** | Sliding Bolt (CP), 450 mm long. | Each | **584** |
| **28-244** | Soap tray. | Each | **312** |
| **28-245** | 1st Class Soft wood, Deodar. | Cum | 141500 |
| **28-246** | Soil Aggregates, 40 mm to 50 mm. | Cum | **1324** |
| **28-247** | Speed Breaker plastic 350 mm x 500 mm x 50 mm with reflectorized metal. | Mtr | 13500 |
| **28-248** | Speed Breaker plastic 350 mm x 500 mm x 50 mm with reflectorized PPM rubber. | Mtr | 6500 |
| **28-249** | Speed Breaker plastic 350 mm x 500 mm x 50 mm. | Mtr | 8500 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| **28-250** | Steel Chowkat, 16 gauge. | Kg | 150 |
| **28-251** | Steel Chowkat, 18 gauge. | **Kg** | **146** |
| **28-252** | Steel corrugated galvanized sheeting, 20 gauge of any standard size. | Tonne | **146900** |
| **28-253** | Steel corrugated galvanized sheeting, 22 gauge of any standard size. | Tonne | **151844** |
| **28-254** | Steel corrugated galvanized sheeting, 24 gauge of any standard size. | Tonne | **152210** |
| **28-255** | Steel Galvanised Sheets, 18 gauge. | Sqm | **1513** |
| **28-256** | Steel Galvanised Sheets, 20 gauge. | Sqm | **1228** |
| **28-257** | Steel Galvanised Sheets, 22 gauge. | Sqm | 1028 |
| **28-258** | Steel Galvanised Sheets, 24 gauge in walls floor ceiling. | Sqm | **835** |
| **28-259** | Stone dust (Khaka). | Cum | 1103 |
| **28-260** | Stones, Random Rubble, Roughly dressed. | Cum | 1059 |
| **28-261** | Synthetic vinyl (PVC) flexible membrane, 0.25 mm thick. | Sqm | **258** |
| **28-262** | Synthetic vinyl (PVC) flexible membrane, 0.5 mm thick. | Sqm | **516** |
| **28-263** | Synthetic vinyl (PVC) flexible membrane, 1.0 mm thick. | Sqm | 1046 |
| **28-264** | Synthetic vinyl (PVC) flexible membrane, 2.0 mm thick. | Sqm | **1821** |
| **28-265** | Tee Stop cock CP. | Each | **684** |
| **28-266** | Termite Proofing Chemical. | Ltr | **4800** |
| **28-267** | Thermopore Tiles, 600 mm x 600 mm x 20 mm. | Sqm | **323** |
| **28-268** | Tiles (Glazed/ Non-skid/ Matt), Standard quality not exceeding 1600 sq cm | Sqm | **1890** |
| **28-269** | Tiles (Glazed / Non-skid / Matt), Deluxe quality exceeding 1600 sq cm but not 3700 sq cm. | Sqm | **2529** |
| **28-270** | Tiles (Glazed / Non-skid/ Matt), Premium quality exceeding 3700 sq cm. | Sqm | **2860** |
| **28-271** | Tiles Granite 20 mm thick, Standard Quality. | Sqm | **2727** |
| **28-272** | Tiles Granite 20 mm thick, Deluxe Quality. | Sqm | **5023** |
| **28-273** | Tiles Granite 20 mm thick, Premium Quality. | Sqm | **7727** |
| **28-274** | Tiles Marble 13 mm thick, Standard Quality. | Sqm | 630 |
| **28-275** | Tiles Marble 20 mm thick, Standard Quality. | Sqm | **2338** |
| **28-276** | Tiles Marble 13 mm thick, Deluxe Quality. | Sqm | **1236** |
| **28-277** | Tiles Marble 20 mm thick, Deluxe Quality. | Sqm | **4876** |
| **28-278** | Tiles Marble 13 mm thick, Premium Quality. | Sqm | 5005 |
| **28-279** | Tiles Marble 20 mm thick, Premium Quality. | Sqm | 12110 |
| **28-280** | Tiles Mosaic 300 x 300 x 25 mm of ordinary cement. | Each | **65** |
| **28-281** | Tiles Mosaic 300 x 300 x 25 mm of white cement. | Each | **76** |
| **28-282** | Toilet paper holder, Plastic. | Each | **497** |
| **28-283** | Toilet shower, 15 mm dia. | Each | 1101 |
| **28-284** | Torch Bonding Bituminous membrane, 3 mm thick. | Sqm | 851 |
| **28-285** | Torch Bonding Bituminous membrane, 4 mm thick. | Sqm | 1069 |
| **28-286** | Towel Rail CP, Double rod. | Each | 1107 |
| **28-287** | Towel Rail CP, Single rod. | Each | 996 |
| **28-288** | Teak Ply, 3 mm thick. | Sqm | 410 |
| 28-289 | U bolts, 10 mm dia. | **C.No** | **28** |
| **28-290** | uPVC Door Handle. | Each | 805 |
| **28-291** | uPVC Door Hinges 2D. | Each | **895** |
| **28-292** | uPVC Door Lock. | Each | **4025** |

| j Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-293 | uPVC soil and waste pipe, 200 mm. | Meter | 1211 |
| 28-294 | uPVC soil and waste pipe, 300 mm. | Meter | 1868 |
| 28-295 | uPVC P Trap, 75 mm. | Each | 243 |
| 28-296 | uPVC P Trap, 100 mm. | Each | 366 |
| 28-297 | uPVC Floor Trap, 100 mm. | Each | 515 |
| 28-298 | Urinal Basin. | Each | 4126 |
| 28-299 | Vanity Bowel. | Each | 4528 |
| 28-300 | Venetian Blind, Horizontal, having metallic, plastic strip upto 25 mm width. | Sft | 166 |
| 28-301 | Venetian Blind, Vertical, having fabric strip upto 90 mm width. | Sft | 282 |
| 28-302 | Venetian Blind, Vertical having fabric strip width exceeding 90 mm width upto 127 mm. | Sft | 312 |
| 28-303 | Venation Blind,Horizontal, having wooden strip. | Sft | 332 |
| 28-304 | W.C Asiatic Pattern with Plastic Flushing tank. | Each | 4254 |
| 28-305 | W.C Closet Pan European pattern. | Each | 2516 |
| 28-306 | W.C Closet with Cistern any Colour with Seat Cover (non-coupled). | Each | 6591 |
| 28-307 | Wall Paper. | Sqm | 1000 |
| 28-308 | Wall Shower, Standard Quality. | Each | 11180 |
| 28-309 | Wall Shower, Deluxe Quality. | Each | 15460 |
| 28-310 | Wall Shower, Premium Quality. | Each | 21822 |
| 28-311 | Wash Hand Basin (WHB), Standard Quality. | Each | 5680 |
| 28-312 | Wash Hand Basin (WHB), Deluxe Quality. | Each | 7500 |
| 28-313 | Wash Hand Basin (WHB), Premium Quality. | Each | 9985 |
| 28-314 | Wash Hand Basin (WHB), Glazed. | Each | 2666 |
| 28-315 | Waste coupling. | Each | 252 |
| 28-316 | Waste Pipe PVC. | Each | 100 |
| 28-317 | Water bound macadam. | Cum | 1324 |
| 28-318 | Water Closet (WC), European pattern (coupled), Standard Quality. | Each | 10500 |
| 28-319 | Water Closet (WC), European pattern (coupled), Deluxe Quality. | Each | 13150 |
| 28-320 | Water Closet (WC), European pattern (coupled), Premium Quality. | Each | 18190 |
| 28-321 | Water Proofing textile geo membrane, 0.25 mm thick. | Sqm | 402 |
| 28-322 | Water stopper PVC, 225 mm wide, 5 mm thick. | Mtr | 656 |
| 28-323 | Water stopper PVC, 225 mm wide, 8 mm thick. | Mtr | 1148 |
| 28-324 | Water stopper PVC, 250 mm wide, 10 mm thick. | Mtr | 1641 |
| 28-325 | Water stopper PVC, 250 mm wide, 12 mm thick. | Mtr | 1805 |
| 28-326 | we wall mounted. | Each | 12542 |
| 28-327 | V\{ire Plain galvanized, 8 SWG. | Metre | 20 |
| 28-328 | Wire Plain galvanized, 12 SWG. | Metre | 12 |
| 28-329 | Wire Plain galvanized, 14 SWG. | Metre | 8 |
| 28-330 | Wire Plain galvanized, 16 SWG. | Metre | 7 |
| 28-331 | Wire Gauze 9x9 mesh, 24 Gauge. | Sqm | 660 |
| 28-332 | Wire Gauze Aluminium16 x 16 mesh, 26 Gauge. | Sqm | 552 |
| 28-333 | Wire Gauze iron Tinned 9 x 9 mesh, 22 Gauge. | Sqm | 747 |
| 28-334 | Wire Gauze, Mosquito Proof, 16 x 16 mesh 26 gauge. | Sqm | 811 |
| 28-335 | Wire Gauze, Mosquito Proof, 18 x 18 mesh 28 gauge. | Sqm | 171 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 28-336 | Wire mattress, GI 100 mm x 100 mm. | Sqm | 800 |
| 28-337 | Wire mattress, GI 150 mm x 150 mm. | Sqm | 650 |
| 28-338 | Wire Netting Galvanised, 25 mm mesh, 14 SWG. | Sqm | 454 |
| 28-339 | Wire Netting Galvanised, 25 mm x 25 mm mesh, 12 SWG. | Sqm | 639 |
| 28-340 | Wire Netting Galvanised, 40 mm mesh, 14 SWG. | Sqm | 422 |
| 28-341 | Wire Netting Galvanised, 40 mm x 40 mm mesh, 12 SWG. | Sqm | 455 |
| 28-342 | Wire Netting Galvanised, 50 mm mesh, 14 SWG. | Sqm | 238 |
| 28-343 | Wire Netting Galvanised, 50 mm x 50 mm mesh, 10 SWG. | Sqm | 320 |
| 28-344 | Wire Netting Galvanised, 50 mm x 50 mm mesh, 12 SWG. | Sqm | 325 |
| 28-345 | Wire Netting Galvanised, 75 mm x 75 mm mesh, 10 SWG. | Sqm | 303 |
| 28-346 | Wire Netting Galvanised, 75 mm x 75 mm mesh, 12 SWG. | Sqm | 225 |
| 28-347 | Wooden Laminated Tiles, 8 mm thick. | Sqm | 1515 |
| 28-348 | Wooden Laminated Tiles, 12 mm thick. | Sqm | 3574 |
| 28-349 | Water proof Drying System (WDS) Additive. | Kg | 520 |
| 28-350 | 6 Pieces Bath Set (Double Bib Cock and Toilet Shower etc.), Standard Quality. | Each | 24000 |
| 28-351 | 6 Pieces Bath Set (Double Bib Cock and Toilet Shower etc.), Deluxe Quality. | Each | 27400 |
| 28-352 | 6 Pieces Bath Set (Double Bib Cock and Toilet Shower etc.), Premium Quality. | Each | 36000 |
| 28-353 | | Each | 18600 |
| 28-354 | | Each | 28730 |
| 28-355 | | Each | 43540 |

# SECTION-29

# MATERIAL SUPPLY ONLY -RATES

# (ELECTRIFICATION, WATER SUPPLY AND NATRUAL GAS)

# RECORD OF AMENDMENTS

| `SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# SECTION-29

## MATERIAL SUPPLY ONLY RATES

### Electrification, Water Supply, Natural Gas etc.

1. The rates for materials given below have been used in compiling the item rates in this schedule and the same will be used as defined in General Rules. In case where MES Stores are issued to the contractors under various contracts on payment, the recovery will be affected at these rates as given in. General Rules.

2. Specification has been made generic and not to include references to brand names, model numbers, catalogue numbers or similar classifications in the light of Pakistan Engineering Council, PPRA & FIDIC Rules.

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Power Transformer** | | |
| 29-1 | **Power Transformer,** step down 11000/400/230 V, 3 phase 50 cycles, indoor/outdoor 25 KVA, Type "A" (excluding cost of platform). | Each | 235200 |
| 29-2 | Same as item 29-1, but 25 KVA, Type "B-". | Each | 210600 |
| 29-3 | Same as item 29-1, but 25 KVA, Type "C". | Each | 157950 |
| 29-4 | Same as item 29-1, but 50 KVA, Type "A". | Each | 360000 |
| 29-5 | Same as item 29-4, but 50 KVA, Type "B". | Each | 292500 |
| 29-6 | Same as item 29-4, but 50 KVA, Type "C". | Each | 234000 |
| 29-7 | Same as item 29-1, but 100 KVA, Type "A". | Each | 516000 |
| 29-8 | Same as item 29-7, but 100 KVA, Type "B". | Each | 432900 |
| 29-9 | Same as item 29-7, but 100 KVA, Type "C". | Each | 385000 |
| 29-10 | Same as item 29-1, but 150 KVA, Type "A". | Each | 693600 |
| 29-11 | Same as item 29-10, but 150 KVA, Type "B". | Each | 555750 |
| 29-12 | Same as item 29-10, but 150 KVA, Type "C". | Each | 468000 |
| 29-13 | Same as item 29-1, but 200 KVA, Type "A". | Each | 871200 |
| 29-14 | Same as item 29-13, but 200 KVA, Type "B". | Each | 661050 |
| 29-15 | Same as item 29-13, but 200 KVA, Type "C". | Each | 561600 |
| 29-16 | Same as item 29-1, but 250 KVA, Type "A". | Each | 1046400 |
| 29-17 | Same as item 29-16, but 250 KVA, Type "B". | Each | 713700 |
| 29-18 | Same as item 29-16, but 250 KVA, Type "C". | Each | 643500 |
| 29-19 | Same as item 29-1, but 300 KVA, Type "A". | Each | 1221600 |
| 29-20 | Same as item 29-19, but 300 KVA, Type "B". | Each | 754650 |
| 29-21 | Same as item 29-19, but 300 KVA, Type "C". | Each | 731250 |
| 29-22 | Same as item 29-1, but 400 KVA, Type "A". | Each | 1572000 |
| 29-23 | Same as item 29-22, but 400 KVA, Type "B". | Each | 1134900 |
| 29-24 | Same as item 29-22, but 400 KVA, Type "C". | Each | 1090000 |
| 29-25 | Same as item 29-1, but 500 KVA, Type "A". | Each | 1842000 |
| 29-26 | Same as item 29-25, but 500 KVA, Type "B". | Each | 1275300 |
| 29-27 | Same as item 29-25, but 500 KVA, Type "C". | Each | 1220000 |
| 29-28 | Same as item 29-1, but 630 KVA, Type "A". | Each | 2112000 |
| 29-29 | Same as item 29-28, but 630 KVA, Type "B". | Each | 1380600 |
| 29-30 | Same as item 29-28, but 630 KVA, Type "C". | Each | 1287000 |
| 29-31 | Same as item 29-1, but 1000 KVA, Type "A". | Each | 2520000 |
| 29-32 | Same as item 29-31, but 1000 KVA, Type "B". | Each | 1702360 |
| 29-33 | Same as item 29-31, but 1000 KVA, Type "C". | Each | 1595000 |
| | **Power Transformers - Pad Mounted** | | |
| 29-34 | Power Transformer pad mounted type, 3 phase, oil immersed, | Each | 689565 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | naturally cooled, step down 11000/400/230 V, 50 cycles comprising with High/Low Voltage compartments and controls 25 KVA, Type "A" (excluding pad), | | |
| 29-35 | Same as item 29-34 but 25 KVA, Type "B". | Each | 336960 |
| 29-36 | Same as item 29-34, but 25 KVA, Type "C". | Each | 265000 |
| 29-37 | Same as item 29-34, but 50 KVA, Type "A". | Each | 828533 |
| 29-38 | Same as item 29-37, but 50 KVA, Type "B". | Each | 473850 |
| 29-39 | Same as item 29-37, but 50 KVA, Type "C". | Each | 387000 |
| 29-40 | Same as item 29-34, but 100 KVA, Type "A". | Each | 967965 |
| 29-41 | Same as item 29-40, but 100 KVA, Type "B". | Each | 748800 |
| 29-42 | Same as item 29-40, but 100 KVA, Type "C". | Each | 576000 |
| 29-43 | Same as item 29-34, but 150 KVA, Type "A". | Each | 1163836 |
| 29-44 | Same as item 29-43, but 150 KVA, Type "B". | Each | 877500 |
| 29-45 | Same as item 29-43, but 150 KVA, Type "C". | Each | 852930 |
| 29-46 | Same as item 29-34, but 200 KVA, Type "A". | Each | 1440997 |
| 29-47 | Same as item 29-46, but 200 KVA, Type "B". | Each | 1053000 |
| 29-48 | Same as item 29-46, but 200 KVA, Type "C". | Each | 1041300 |
| 29-49 | Same as item 29-34, but 250 KVA, Type "A". | Each | 1765295 |
| 29-50 | Same as item 29-49, but 250 KVA, Type "B". | Each | 1123200 |
| 29-51 | Same as item 29-49, but 250 KVA, Type "C". | Each | 987000 |
| 29-52 | Same as item 29-34, but 300 KVA, Type "A". | Each | 1924895 |
| 29-53 | Same as item 29-52, but 300 KVA, Type "B". | Each | 1187550 |
| 29-54 | Same as item 29-52, but 300 KVA, Type "C". | Each | 1085000 |
| 29-55 | Same as item 29-34, but 400 KVA, Type "A". | Each | 2245643 |
| 29-56 | Same as item 29-55, but 400 KVA, Type "B". | Each | 1696500 |
| 29-57 | Same as item 29-55, but 400 KVA, Type "C". | Each | 1435000 |
| 29-58 | Same as item 29-34, but 500 KVA, Type "A". | Each | 2737099 |
| 29-59 | Same as item 29-58, but 500 KVA, Type "B". | Each | 2000700 |
| 29-60 | Same as item 29-58, but 500 KVA, Type "C". | Each | 1575000 |
| 29-61 | Same as item 29-34, but 630 KVA, Type "A". | Each | 3099228 |
| 29-62 | Same as item 29-61, but 630 KVA, Type "B". | Each | 2164500 |
| 29-63 | Same as item 29-61, but 630 KVA, Type "C". | Each | 1748000 |
| 29-64 | Same as item 29-34, but 1000 KVA, Type "A". | Each | 3757525 |
| 29-65 | Same as item 29-64, but 1000 KVA, Type "B". | Each | 2398500 |
| 29-66 | Same as item 29-64, but 1000 KVA, Type "C". | Each | 2632500 |
| | **DRY Type Transformer Copper winding "F" Class insulation** | | |
| 29-67 | Dry type indoor, power transformer having continuous rating of 11000/400/230 V, 3 phase, 50 HZ, having off load tap changing arrangement on high voltage side. The taping to be provided for variation of high voltage from -10% to +5% in seven step of 2.5% each, for **Copper winding** "F" Class insulation. Capacity 100 KVA. (EU Origin) | Each | 2570000 |
| 29-68 | Same as Item 29-67 but capacity 200 KVA. | Each | 2840000 |
| 29-69 | Same as Item 29-67 but capacity 400 KVA. | Each | 3730000 |
| 29-70 | Same as Item 29-67 but capacity 500 KVA. | Each | 4000000 |
| 29-71 | Same as Item 29-67 but capacity 630 KVA. | Each | 4100000 |
| 29-72 | Same as Item 29-67 but capacity 800 KVA. | Each | 4590000 |
| 29-73 | Same as Item 29-67 but capacity 1000 KVA. | Each | 5590000 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **DRY Type Transformer Aluminium winding "F" Class insulation** | | |
| 29-74 | Dry type indoor, power transformer having continuous rating of 11000/400/230 V, 3 phase, 50 HZ, having off load tap changing arrangement on high voltage side. The taping to be provided for variation of high voltage from -10% to +5% in seven step of 2.5% each, Aluminium winding, for "F" Class insulation. Capacity 100 KVA. (EU Origin) | Each | 1980000 |
| 29-75 | Same as Item 29-74 but capacity 200 KVA. | Each | 2140000 |
| 29-76 | Same as Item 29-74 but capacity 400 KVA. | Each | 2430000 |
| 29-77 | Same as Item 29-74 but capacity 500 KVA. | Each | 2800000 |
| 29-78 | Same as Item 29-74 but capacity 630 KVA. | Each | 3110000 |
| 29-79 | Same as Item 29-74 but capacity 800 KVA. | Each | 3380000 |
| 29-80 | Same as Item 29-75 but capacity 1000 KVA. | Each | 3520000 |
| 29-81 | Potential Transformer (PT) 100/230 V or 110 V for HT panel. | Each | |
| | **Pole Steel Tubular** | | |
| 29-82 | Pole steel tubular, un-galvanized, upto 9 M long, complete with base plate, as specified in Section-25. | Each | 24511 |
| 29-83 | Same as item 29-82, but galvanized. | Each | 33162 |
| 29-84 | Pole tubular, un-galvanized upto 12 M long, complete with base plate, as specified in Section-25. | Each | 35256 |
| 29-85 | Same as item 29-84, but galvanized. | Each | 47701 |
| 29-86 | Pole steel tubular un-galvanized up to 10.792 M long for street light, single arm, complete with base plate, as specified in Section-25. | Each | 29000 |
| 29-87 | Same as item 29-86, but galvanized. | Each | 34000 |
| 29-88 | Pole steel tubular un- galvanized up to 10.792 M long for street light, double arm, complete with base plate, as specified in Section-25. | Each | 31000 |
| 29-89 | Same as item 29-88, but galvanized. | Each | 37200 |
| 29-90 | Steel pole Lattice "L" type un-galvanized, as specified in Section 25 as per WAPDA drawing No. PDW/DF-10. | Each | 22815 |
| 29-91 | Same as item 29-90, but galvanized. | Each | 28080 |
| 29-92 | Steel pole Lattice "H" type un-galvanized, as specified in Section 25, as per WAPDA drawing No. PDW/DF-11. | Each | 32760 |
| 29-93 | Same as item 29-92, but galvanized. | Each | 37440 |
| 29-94 | Street Light Pole Round conical, galvanized, 9 metre long, including "J" bolt Set, single arm, as specified in Section 25. | Each | -42000 |
| 29-95 | Same as item 29-94, butdouble arm, as specified in Section 25. | Each | 45000 |
| 29-96 | Street Light Pole Round conical, galvanized, 10 metre long, including "J" Bolt Set, single Arm as specified in Section 25. | Each | 49000 |
| 29-97 | Same as item 29-96, but double arm, as specified in Section 25. | Each | 52000 |
| 29-98 | Street Light Pole Round conical, galvanized, 12 metre long including "J" Bolt Set, single arm, as specified in Section 25. | Each | 63300 |
| 29-99 | Same as item 29-98, but double arm, as specified in Section 25. | Each | 65700 |
| 29-100 | Street Light Pole Round Octagonal, galvanized 9 metre long, including "J" Bolt Set, single arm, as specified in Section 25. | Each | 42000 |
| 29-101 | Same as item 29-100, but double arm, as specified in Section 25. | Each | 45000 |
| 29-102 | Street Light Pole round Octagonal, galvanized 10 metre long, including "J" Bolt Set, single arm, as specified in Section 25. | Each | 49000 |
| 29-103 | Same as item 29-102, but double arm, as specified in Section 25. | Each | 52000 |
| 29-104 | Street Light Pole Octagonal, galvanized 12 metre long, including "J" Bolt Set, single arm, as specified in Section 25. | Each | 61600 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-105 | Same as item 29-104, but double arm as specified in Section 25. | Each | 64100 |
| 29-106 | Wire stay, steel galvanized, stranded, all sizes. | **KG** | 175 |
| 29-107 | Stay assembly, comprising elbow, rod and washers, as per BS No. 16, for use with stay wire 7/10 SWG. 13.75 M long. | Each | 3200 |
| 29-108 | Insulators pin, glazed, porcelain, vitreous or glass caps galvanized pins, max dia in groove 150 mm, LT. | Each | 293 |
| 29-109 | Same as item 29-108, but for HT, upto 11 KV. | Each | 807 |
| 29-110 | Insulators shackle with straps, or D/iron for cross arms upto 30 mm deep and 175 mm max top dia, LT. | Each | 304 |
| 29-111 | Insulator for stay. | Each | 80 |
| 29-112 | Capacitor for fan/motor, 2.2 µF, 250 V. | Each | 93 |
| 29-113 | Same as item 29-112 but 2.5 µF, 250 V. | Each | 105 |
| 29-114 | Same as item 29-112 but 3.00 µF, 250 V. | Each | 129 |
| 29-115 | Same as item 29-112 but 3.50 µF, 250 V. | Each | 140 |
| 29-116 | Same as item 29-112 but 4 µF, 250 V. | Each | 164 |
| 29-117 | Same as item 29-112 but 4.50 µF, 250 V. | Each | 175 |
| 29-118 | Same as item 29-112 but 12 µF, 250 V. | Each | 351 |
| 29-119 | Same as item 29-112 but 25 µF, 250 V. | Each | 468 |
| 29-120 | Same as item 29-112 but 30 µF, 250 V. | Each | 643 |
| 29-121 | Conduit tubing black or galvanized, ET, 20 mm dia. | Metre | 134 |
| 29-122 | Same as item 29-121, but 25 mm dia. | Metre | 170 |
| 29-123 | Same as item 29-121, but 40 mm dia. | Metre | **269** |
| 29-124 | Same as item 29-121, but 50 mm dia. | Metre | 479 |
| 29-125 | Tee solid or inspection 20 mm dia. | Each | 53 |
| 29-126 | Same as item 29-125, but 25 mm dia. | Each | 129 |
| 29-127 | Same as item 29-125, but 40 mm dia. | Each | 257 |
| 29-128 | Same as item 29-125, but 50 mm dia. | Each | 328 |
| 29-129 | Elbow solid or inspection 20 mm dia. | Each | 56 |
| 29-130 | Same as item 29-129, but 25 mm dia. | Each | 76 |
| 29-131 | Same as item 29-129, but 40 mm dia. | Each | 166 |
| 29-132 | Same as item 29-129, but 50 mm dia. | Each | 221 |
| 29-133 | Bend 90°, solid or inspection, 20 mm dia. | Each | 56 |
| 29-134 | Same as item 29-133, but 25 mm dia. | Each | 76 |
| 29-135 | Same as item 29-133, but 40 mm dia. | Each | 166 |
| 29-136 | Same as item 29-133, but 50 mm dia. | Each | 221 |
| 29-137 | Bush male or female, 20 mm dia. | Each | 25 |
| 29-138 | Same as item 29-137, but 25 mm dia. | Each | 456 |
| 29-139 | Same as item 29-137, but 40 mm dia. | Each | 85 |
| 29-140 | Same as item 29-137, but 50 mm dia. | Each | 100 |
| 29-141 | Lock nuts, 15 mm dia. | Each | 14 |
| 29-142 | Same as item 29-141, but 20 mm dia. | Each | 29 |
| 29-143 | Same as item 29-141, but 25 mm dia. | Each | 29 |
| 29-144 | Same as item 29-141, but 30 mm dia. | Each | 41 |
| 29-145 | Saddles, spacer bar, 20 mm dia. | Dozen | 41 |
| 29-146 | Same as item 29-145, but 25 mm dia. | Dozen | 53 |
| 29-147 | Same as item 29-145, but 40 mm dia. | Dozen | 84 |
| 29-148 | Same as item 29-145, but 50 mm dia. | Dozen | 111 |

| SINO | Description | Unit | Rate (Rs) |
|---|---|---|---|
| | **Cable PVC, Sheathed** | | |
| 29-149 | Cable electric, PVC insulated 250/440 V, with stranded copper conductor, 3 /.029. | Coil (90 M) | 1911 |
| 29-150 | Same as item, 29-149, but 3/.036. | Coil (90 M) | 2808 |
| 29-151 | Same as item, 29-149, but 7/.029. | Coil (90 M) | 4011 |
| 29-152 | Cable electric, PVC insulated, 250/440 V, with solid copper conductor, 1mm$^2$. | Coil (90 M) | 1372 |
| 29-153 | Same as item 29-152, but 1.5 mm$^2$. | Coil (90 M) | 2247 |
| 29-154 | Same as item 29-152, but 2.5 mm$^2$. | Coil (90 M) | 3808 |
| 29-155 | Cable electric, PVC insulated, 250/440 V, single core, with stranded copper conductor, 4mm$^2$. | Coil (90 M) | 5362 |
| 29-156 | Same as item 29-155, but 6 mm$^2$. | Coil (90 M) | 7777 |
| 29-157 | Same as item 29-155, but 10 mm$^2$. | Coil (90 M) | 13160 |
| 29-158 | Same as item 29-155, but 16 mm$^2$. | Coil (90 M) | 20220 |
| 29-159 | Same as item 29-155, but 25 mm$^2$. | Coil (90 M) | 28170 |
| 29-160 | Same as item 29-155, but 35 mm$^2$. | Coil (90 M) | 37980 |
| 29-161 | Same as item 29-155, but 50 mm$^2$. | Coil (90 M) | 52830 |
| 29-162 | Same as item 29-155, but 70 mm$^2$. | Coil (90 M) | 76140 |
| 29-163 | Cable electric, flexible, 0.75 mm$^2$ twin core. | Metre | 63 |
| 29-164 | Cable electric, PVC insulated, PVC sheathed, 600/1000 V, twin core with copper conductor 4 mm$^2$. | Metre | 130 |
| 29-165 | Same as item 29-164, but 6 mm$^2$. | Metre | 189 |
| 29-166 | Same as item 29-164, but 10 mm$^2$. | Metre | 322 |
| 29-167 | Same as item 29-164, but 16 mm$^2$. | Metre | 506 |
| 29-168 | Same as item 29-164, but 25 mm$^2$. | Metre | 712 |
| 29-169 | Same as item 29-164, with Aluminium conductor but 10 mm$^2$. | Metre | 82 |
| 29-170 | Same as item 29-169, but 16 mm$^2$. | Metre | 125 |
| 29-171 | Same as item 29-169 but 25 mm$^2$. | Metre | 181 |
| 29-172 | Chlorine gasmasks, full vision, twin lens face piece, chest harness and chlorine protection, industrial canister (filter) with hose etc, all packed in weather proof carrying bag. | Each | 12870 |
| 29-173 | Electric bell, "Bir 's voice" single phase, 220/230 V, AC. | Each | 180 |
| 29-174 | Ding-dong electric bell, single phase 200/230 V, AC. | Each | 175 |
| 29-175 | Remote control bell. | Each | 650 |
| 29-176 | Earth leakage circuit breaker, 4 pole, 500/660 V, 50/60 cycles, complete with earth leakage overload and short-circuit protection, 100 A (breaking capacity 1.5 KA) (EU Origin). | Each | 63000 |
| 29-177 | Same as item 29-176 but above 75 upto 90 A. | Each | 60000 |
| 29-178 | Same as item 29-176 but above 50 upto 75 A. | Each | 55000 |
| 29-179 | Same as item 29-176 but, above 30 upto 50 A. | Each | 12600 |
| 29-180 | Same as item 29-176 but 10 upto 30 A. | Each | 11760 |
| | **Electric Fans AC** | | |
| 29-181 | Ceiling Fan 48" & 56" standard. | Each | 3533 |
| 29-182 | Same as item 29-181 but Deluxe. | Each | 3840 |
| 29-183 | Same as item 29-181 Premium. | Each | 5867 |
| 29-184 | Exhaust Fan Single & Double way 8" & 1O" Standard. | Each | 2145 |
| 2ij. 1 -. | Same as item 29-184 but 8 & 10" Deluxe. | Each | 2250 |
| 29-186 | Same as item 29-184 but 8" & 10" Premium. | Each | 2443 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-187 | Same as item 29-184 but 12" Standard. | Each | 2433 |
| 29-188 | Same as item 29-184 but 12" Deluxe. | Each | 2531 |
| 29-189 | Same as item 29-184 but 12" Premium. | Each | 2806 |
| 29-190 | Exhaust Fan 6" & 8" Metal body Standard. | Each | 1631 |
| 29-191 | Same as item 29-190 but Exhaust Fan 6" & 8" Metal body Deluxe. | Each | 1901 |
| 29-192 | Same as item 29-190 but 6" & 8" Metal body Premium. | Each | 2123 |
| 29-193 | Same as item 29-190 but 10" & 12" Metal body Standard. | Each | 2232 |
| 29-194 | Same as item 29-190 but 1O" & 12" Metal body Deluxe. | Each | 2260 |
| 29-195 | Same as item 29-190 but 10" & 12" Metal body Premium. | Each | 2561 |
| 29-196 | Same as item 29-190 but 16" & 18" Metal body Standard. | Each | 3496 |
| 29-197 | Same as item 29-190 but 16" & 18" Metal body Deluxe. | Each | 3583 |
| 29-198 | Same as item 29-190 but 16" & 18" Metal body Premium. | Each | 3883 |
| 29-199 | Same as item 29-190 but 20" & 24" Metal body Standard. | Each | 4314 |
| 29-200 | Same as item 29-190 but 20" & 24" Metal body Deluxe. | Each | 4400 |
| 29-201 | Same as item 29-190 but 20" & 24" Metal body Premium. | Each | 4784 |
| 29-202 | Bracket Fan 12" & 14" Standard. | Each | 2580 |
| 29-203 | Same as item 29-202 but 12" & 14" Deluxe. | Each | 2852 |
| 29-204 | Same as item 29-202 but 12" & 14" Premium. | Each | 3013 |
| 29-205 | Same as item 29-202 but 20" & 24" Standard. | Each | 4061 |
| 29-206 | Same as item 29-202 but 20" & 24" Deluxe. | Each | 4787 |
| 29-207 | Same as item 29-202 but 20" & 24" Premium. | Each | 6150 |
| 29-208 | Circiomatic Fan deluxe w/o regulator, 24" (600 mm). | Each | 4105 |
| 29-209 | Same as item 29-208, but 18" (450 mm). | Each | 3995 |
| 29-210 | Same as item 29-208 but 16" (400 mm). | Each | 3845 |
| 29-211 | Same as item 29-208 but 14" (350 mm). | Each | 3740 |
| 29-212 | Same as item 29-208 but 12" (300 mm). | Each | 3545 |
| | **Pedestal Fan** | | |
| 29-213 | Pedestal Fan with copper winding 16". | Each | 4565 |
| 29-214 | Same as item 29-213, but 18". | Each | 4690 |
| 29-215 | Same as item 29-213, but 20". | Each | 5955 |
| 29-216 | Same as item 29-213, but 22". | Each | 6055 |
| 29-217 | Same as item 29-213, but 24". | Each | 6575 |
| 29-218 | Same as item 29-213, but 26". | Each | 7995 |
| | **Electric Water Cooler** | | |
| 29-219 | Electric Water Cooler 220/240 V 35 lit/ hr. | Each | 31700 |
| 29-220 | Same as item 29-219, but 45 lit/ hr. | Each | 33700 |
| 29-221 | Same as item 29-219, but 65 lit/ hr. | Each | 36200 |
| 29-222 | Same as item 29-219, but 85 lit/ hr. | Each | 42900 |
| 29-223 | Same as item 29-219, but 100 lit/ hr. | Each | 51400 |
| 29-224 | Same as item 29-219, but 200 lit/ hr. | Each | 126300 |
| | **LED Lights** | | |
| 29-225 | Strip light 2 ft LED, complete, Standard. | Each | 540 |
| 29-226 | Same as item 29-225 but Deluxe. | Each | 850 |
| 29-227 | Same as item 29-225 but Premium. | Each | 2060 |
| 29-228 | Strip light 4 ft LED, complete, Standard. | Each | 1080 |
| 29-229 | Same as item 29-228 but Deluxe. | Each | 1550 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-230 | Same as item 29-228 but Premium. | Each | 3150 |
| 29-231 | LED Panel Light Recessed, 6 watt, Standard. | Each | 325 |
| 29-232 | Same as item 29-231, but Deluxe. | Each | 550 |
| 29-233 | Same as item 29-231, but Premium. | Each | 787 |
| 29-234 | Same as item 29-231, but 12 watt, Standard. | Each | 605 |
| 29-235 | Same as item 29-231, but 12 watt, Deluxe. | Each | 875 |
| 29-236 | Same as item 29-231, but 12 watt, Premium. | Each | 1195·- |
| 29-237 | Same as item 29-231, but 18 watt, Standard. | Each | 83Q:· |
| 29-238 | Same as item 29-231, but 18 watt, Deluxe. | Each | 1267 |
| 29-239 | Same as item 29-231, but 18 watt, Premium. | Each | 1625 |
| 29-240 | Same as item 29-231, but 24 watt, Standard. | Each | 1400 |
| 29-241 | Same as item 29-231, but 24 watt, Deluxe. | Each | 1440 |
| 29-242 | Same as item 29-231, but 24 watt, Premium. | Each | 3063 |
| 29-243 | LED Down Light, 7 watt, Standard. | Each | 360 |
| 29-244 | Same as item 29-243, but 7 watt, Deluxe. | Each | 435 |
| 29-245 | Same as item 29-243, but 7 watt, Premium. | Each | 485 |
| 29-246 | Same as item 29-243, but 12 watt, Standard. | Each | 585 |
| 29-247 | Same as item 29-243, but 12 watt, Deluxe. | Each | 740 |
| 29-248 | Same as item 29-243, but 12 watt, Premium. | Each | 750 |
| 29-249 | Same as item 29-243, but 18 watt, Standard. | Each | 810 |
| 29-250 | Same as item 29-243, but 18 watt, Deluxe. | Each | 950 |
| 29-251 | Same as item 29-243, but 18 watt, Premium. | Each | 1250 |
| 29-252 | LED Street Light, 22 watt, Standard. | Each | 3000 |
| 29-253 | Same as item 29-252, but 22 watt, Deluxe. | Each | 6750 |
| 29-254 | Same as item 29-252, but 22 watt, Premium. | Each | 12600 |
| 29-255 | Same as item 29-252, but 27 watt, Standard. | Each | 4000 |
| 29-256 | Same as item 29-252, but 27 watt, Deluxe. | Each | 7100 |
| 29-257 | Same as item 29-252, but 27 watt, Premium. | Each | 13500 |
| 29-258 | Same as item 29-252, but 50 watt, Standard. | Each | 5000 |
| 29-259 | Same as item 29-252, but 50 watt, Deluxe. | Each | 9950 |
| 29-260 | Same as item 29-252, but 50 watt, Premium. | Each | 19500 |
| 29-261 | Same as item 29-252, but 60 watt, Standard. | Each | 9000 |
| 29-262 | Same as item 29-252, but 60 watt, Deluxe. | Each | 10250 |
| 29-263 | Same as item 29-252, but 60 watt, Premium. | Each | 15183 |
| 29-264 | Same as item 29-252, but 70 watt, Standard. | Each | 8000 |
| 29-265 | Same as item 29-252, but 70 watt, Deluxe. | Each | 17000 |
| 29-266 | Same as item 29-252, but 70 watt, Premium. | Each | 28833 |
| 29-267 | Same as item 29-252, but 80 & 90 watt, Standard. | Each | 10500 |
| 29-268 | Same as item 29-252, but 80 & 90 watt, Deluxe. | Each | 20053 |
| 29-269 | Same as item 29-252, but 80 & 90 watt, Premium. | Each | 29666 |
| 29-270 | Same as item 29-252, but 100 & 110 watt, Standard. | Each | 25500 |
| 29-271 | Same as item 29-252, but 100 & 110 watt, Deluxe. | Each | 26500 |
| 29-272 | Same as item 29-252, but 100 & 110 watt, Premium. | Each | 36250 |
| 29-273 | Same as item 29-252, but 120 & 130 watt, Standard. | Each | 17625 |
| 29-274 | Same as item 29-252, but 120 & 130 watt, Deluxe. | Each | 27750 |
| 29-275 | Same as item 29-252, but 120 & 130 watt, Premium. | Each | 34235 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| **29-276** | Same as item 29-252, but 140 & 150 watt, Standard. | Each | 20750 |
| **29-277** | Same as item 29-252, but 140 & 150 watt, Deluxe. | Each | 31250 |
| 29-278 | Same as item 29-252, but 140 & 150 watt, Premium. | Each | 46100 |
| **29-279** | Same as item 29-252, but 160 & 170 watt, Standard. | Each | 22000 |
| **29-280** | Same as item 29-252, but 160 & 170 watt, Deluxe. | Each | 35500 |
| **29-281** | Same as item 29-252, but 160 &170 watt, Premium. | Each | 54850 |
| **29-282** | Same as item 29-252, but 180 watt, Standard. | Each | 31250 |
| **29-283** | Same as item 29-252, but 180 watt, Deluxe. | Each | 31300 |
| **29-284** | Same as item 29-252, but 180 watt, Premium. | Each | 55175 |
| **29-285** | LED Flood Light 30 watt, Standard. | Each | 2900 |
| **29-286** | Same as item 29-285, but 30 watt, Deluxe. | Each | 3650 |
| **29-287** | Same as item 29-285, but 30 watt, Premium. | Each | 12683 |
| **29-288** | Same as item 29-285, but 50 watt, Standard. | Each | 4100 |
| **29-289** | Same as item 29-285, but 50 watt, Deluxe. | Each | 5533 |
| 29-290 | Same as item 29-285, but 50 watt, Premium. | Each | 18875 |
| 29-291 | Same as item 29-285, but 70 watt, Standard. | Each | 8000 |
| **29-292** | Same as item 29-285, but 70 watt, Deluxe. | Each | 9800 |
| **29-293** | Same as item 29-285, but 70 watt, Premium. | Each | 19500 |
| 29-294 | Same as item 29-285, but 100 & 110 watt, Standard. | Each | 8766 |
| 29-295 | Same as item 29-285, but 100 & 110 watt, Deluxe. | Each | 18083 |
| **29-296** | Same as item 29-285, but 100 & 110 watt, Premium. | Each | 29875 |
| 29-297 | Same as item 29-285, but 120 watt, Standard. | Each | 10000 |
| **29-298** | Same as item 29-285, but 120 watt, Deluxe. | Each | 16500 |
| 29-299 | Same as item 29-285, but 120 watt, Premium. | Each | 22000 |
| 29-300 | Same as item 29-285, but 160 watt, Standard. | Each | 13500 |
| 29-301 | Same as item 29-285, but 160 watt, Deluxe. | Each | 17633 |
| 29-302 | Same as item 29-285, but 160 watt, Premium. | Each | 28000 |
| 29-303 | Same as item 29-285, but 200 watt, Standard. | Each | 14500 |
| 29-304 | Same as item 29-285, but 200 watt, Deluxe. | Each | 23333 |
| 29-305 | Same as item 29-285, but 200 watt, Premium. | Each | 37500 |
| 29-306 | Same as item 29-285, but 220 watt, Standard. | Each | 24000 |
| 29-307 | Same as item 29-285, but 220 watt, Deluxe. | Each | 39500 |
| 29-308 | Same as item 29-285, but 220 watt, Premium. | Each | 56500 |
| 29-309 | Same as item 29-285, but 245 watt, Standard. | Each | 37500 |
| 29-310 | Same as item 29-285, but 245 watt, Deluxe. | Each | 52000 |
| 29-311 | Same as item 29-285, but 245 watt, Premium. | Each | 78500 |
| 29-312 | Same as item 29-285, but 315 watt, Standard. | Each | 46000 |
| 29-313 | Same as item 29-285, but 315 watt, Deluxe. | Each | 53000 |
| 29-314 | Same as item 29-285, but 315 watt, Premium. | Each | 54500 |
| 29-315 | Same as item 29-285, but 350 watt, Standard. | Each | 55000 |
| 29-316 | Same as item 29-285, but 350 watt, Deluxe. | Each | 59500 |
| 29-317 | Same as item 29-285, but 350 watt, Premium. | Each | 65000 |
| 29-318 | LED High Bay light 100 watt, Standard. | Each | 15600 |
| 29-319 | Same as item 29-318_, but 100 watt, Deluxe. | Each | 18300 |
| 29-320 | Same as item 29-318, but 100 watt, Premium. | Each | 25900 |
| 29-321 | Same as item 29-318, but 150 watt, Standard. | Each | 18200 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-322 | Same as item 29-318, but 150 watt, Deluxe. | Each | 35000 |
| 29-323 | Same as item 29-318, but 150 watt, Premium. | Each | 35360 |
| 29-324 | LED Bulbs 5 Watts, 220-240 volts. | Each | 140 |
| 29-325 | Same as item 29-324, but 7 Watts, 220-240 volts. | Each | 140 |
| 29-326 | Same as item 29-324, but 12 Watts, 220-240 volts. | Each | 144 |
| 29-327 | Same as item 29-324, but 18 Watts, 220-240 volts. | Each | 261 |
| 29-328 | Same as item 29-324, but 30 Watts, 220-240 volts. | Each | 479 |
| 29-329 | Same as item 29-324, but 50 Watts, 220-240 volts. | Each | 950 |
| | **Fire Alarm System** | | |
| 29-330 | Fire alarm control panel, 2-triggering zones and 2-alarming zones. | Each | 45300 |
| 29-331 | Smoke detector (Ionization Type). | Each | 8200 |
| 29-332 | H at detector (Rise Type). | Each | 7500 |
| 29-333 | Alarm bell 6" dia, gong type. | Each | 8900 |
| 29-334 | Manual call point, break glass type. | Each | 26500 |
| 29-335 | Wiring Installation testing commission with material and labour. | point | 2200 |
| 29-336 | Gate light, fancy type. | Each | 555 |
| 29-337 | Industrial shoe socket complete, 3 phase+ NL+ Earth 5 point, 16 A, Best Quality. | Each | 1491 |
| 29-338 | Same as item 29-337 but 32 A. | Each | 2146 |
| 29-339 | Same as item 29-337 but 63 A. | Each | 6762 |
| | **Fire Extinguisher** | | |
| 29-340 | Fire Extinguisher (Portable CO2) Carbon Dioxide, 7 Kg capacity. | Each | 10413 |
| 29-341 | Fire extinguisher (Portable DCP) dry chemical powder type, 6 Kg capacity. | Each | 2691 |
| 29-342 | Fire extinguisher (Portable DCP) dry chemical powder type, 5 Kg capacity. | Each | 2574 |
| | **Gas Water Heater** | | |
| 29-343 | Dual action Gas cum electric water heater of 12 SWG Black Sheet (inner tank) complete with burner pilot, thermostat and safety valve, with Electric Element & Electric thermostat, 68 lit capacity. | Each | 23355 |
| 29-344 | Same as item 29-343, but 136 lit capacity of 10 SWG black sheet (inner tank). | Each | 26300 |
| 29-345 | Same as item 29-344(inner tank), but 225 lit capacity. | Each | 29500 |
| 29-346 | Gas water heater 12 SWG Black sheet (inner tank) complete with burner, thermostat and pilot, safety valve with conical buffel capacity 70 lit. | Each | 16500 |
| 29-347 | Same as item 29-346 but 140 lit of 10 SWG Black sheet (inner water tank}. | Each | 22700 |
| 29-348 | Same as item 29-347 but 225 lit. | Each | 26325 |
| | **Gas Room Heater** | | |
| 29-349 | Gaf·.-room heater of 10 SWG Black Sheet Complete with pilot, doJ61e burner, double panel. | Each | 7300 |
| 29-350 | Same as item 29-349, but Single burner, double panel. | Each | 5095 |
| | **Gas Burner (Chullah)** | | |
| 29-351 | Gas burner (Chullah), single burner, full tamcheni of 20 SWG Black Sheet | Each | 1696 |
| 29-352 | Same as item 29-351, but double burner, full tamcheni. | Each | 3042 |
| 29-353 | 'Build in burner, non Magnetic steel top, one Large super prime burner and 4 medium burner, non stick paint coated, auto ignition, 3 volt battery operated, complete. | Each | 15180 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-354 | Same as item 26-353, but Glass Top. | Each | 15990 |
| 29-355 | Build in burner non Magnetic, Stainless steel Glass, 2 Large super prime Burner and 1 medium burner, non stick paint coated auto ignition 3 volt Battery operated, complete. | | 11100 |
| 29-356 | Build in burner non Magnetic Stainless steel Glass, 2 Large super prime burner non-stick paint coated, Auto ignition, 3 volt battery operated, Complete. | Each | 8760 |
| | **Gas Cooking Range** | | |
| 29-357 | Gas cooking range of 20 SWG Black sheet two burner 27" single door complete with thermostat, oven, grill, **rotisserie** and tempered (heat-proof) crystal glass (Standard). | Each | 16500 |
| 29-358 | Same as item 29-357, but 3 burner, double door. | Each | 26200 |
| 29-359 | Same as item 29-357, but 34", 3 burner doubte door. | Each | 19300 |
| 29-360 | Same as item 29-357, but 34", 5 burner double door. | Each | 25155 |
| 29-361 | Same as item 29-357, but 34", 3 burner single door. | Each | 22500 |
| | **Tandoor Gas Burners** | | |
| 29-362 | Gas burner, heavy duty, 48 nozzles. | Each | 1950:,. " |
| 29-363 | Same as item 29-362 but 40 nozzles. | Each | 1750 |
| 29-364 | Same as item 29-362 but 32 nozzles. | Each | 1500 |
| 29-365 | Same as item 29-362 but 24 nozzles. | Each | 1200 |
| 29-366 | Same as item 29-362 but 18 nozzles. | Each | 1000 |
| 29-367 | Same as item 29-362 but 12 nozzles. | Each | 750 |
| 29-368 | Gas burner, STAR, heavy duty 12" (300 mm) size. | Each | 1200 |
| 29-369 | Same as item 29-368, but 9" (225 mm) size. | Each | 1050 |
| 29-370 | Same as item 29-368, but 6" (150 mm) size. | Each | 550 |
| 29-371 | Plate for gas tandoor burner 2'-0" (600 mm) size. | Each | 3500 |
| 29-372 | Same as item 29-371, but 1'-6" (450 mm) size. | Each | 3000 |
| | **Refrigerator/Deep Freezer** | | |
| 29-373 | Refrigerator 10 cft. | Each | 35000 |
| 29-374 | Refrigerator 10 cft, deluxe. | | 38750 |
| 29-375 | Same as item 29-374, but 12 cft. | Each | 42500 |
| 29-376 | Same as item 29-374, but 14 cft. | Each | 48000 |
| 29-377 | Same as item 29-374, but 14 cft, Deluxe. | Each | 49750 |
| 29-378 | Deep freezer 14 cft. | Each | 43500 |
| | **Water Purifier/ Filter** | | |
| 29-379 | Water filter, 3 stage, consisting of polypropylene fiber cartridge 5 micron, granular activated carbon cartridge 1 micron, and size of cartridge 10" with ultra violet lamp, water flow rate **2 gpm** complete. | Each | 8120 |
| 29-380 | Same as item 29-379, but 3 gpm. | Each | 13500 |
| 29-381 | Same as item 29-379, but 8 gpm. | Each | 14103 |
| 29-382 | Spun Cart 10". | Each | 2320 |
| . 29-383 | PP Yarn cart 1O" Regular. | Each | 586 |
| 29-384 | pp Yarn 1O" Extra winding Cart Gold. | Each | 977 |
| 29-385 | PP Yarn 10" Jumbo. | Each | 2070 |
| | **Water Tank - Polyethylene (PE)** | | |
| 29-386 | Water tank polyethylene (PE) vertical, 50 gallons, capacity | Each | 2925 |
| 29-387 | Same as item 29-386 but, 150 gallons capacity. | Each | 5265 |
| 29-388 | Same as item 29-386 but, 200 gallons capacity. | Each | 6201 |

| Sl No | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-389 | Same as item 29-386 but, 250 gallons capacity. | Each | 7020 |
| 29-390 | Same as item 29-386 but, 300 gallons capacity. | Each | 8424 |
| 29-391 | Same as item 29-386 but, 400 gallons capacity. | Each | 10530 |
| 29-392 | Same as item 29-386 but, 500 gallons capacity. | Each | 12870 |
| 29-393 | Same as item 29-386 but, 1000 gallons capacity. | Each | 52265 |
| 29-394 | Same as item 29-386 but, horizontal 150 gallons capacity. | Each | 5265 |
| 29-395 | Same as item 29-394 but, 200 gallons capacity. | Each | 6201 |
| 29-396 | Same as item 29-394 but, 250 gallons capacity. | Each | 7020 |
| 29-397 | Same as item 29-394 but, 300 gallons capacity. | Each | 8424 |
| 29-398 | Cable Tray, 16 Gauge GI Sheet, without cover, complete with jointing plates, Cable tray size 4" x 2". | Metre | 673 |
| 29-399 | Same as item 29-398, but Cable tray size 6" x 2". | Metre | 818 |
| 29-400 | Same as item 29-398, but Cable tray size 9" x 2". | Metre | 1041 |
| 29-401 | Same as item 29-398, but Cable tray size 12" x3". | Metre | 1412 |
| 29-402 | Same as item 29-398, but Cable tray size 15" x 3". | Metre | 1636 |
| 29-403 | Same as item 29-398, but Cable tray size 18" x 4". | Metre | 2008 |
| 29-404 | Same as item 29-398, but Cable tray size 24" x 4". | Metre | 2453 |
| 29-405 | Bus Tie Ducts Copper 1000A, TP&N made out of 14 SWG, M.S Sheet, painted with electro static powder coated (paint RAL-7032), complete in all respect. | Metre | 42850 |
| 29-406 | Same as item 29-405, but 1250A, TP&N. | Metre | 57500 |
| 29-407 | Same as item 29-405, but 1600A TP&N. | Metre | 68600 |
| 29-408 | Same as item 29-405, but 2000A TP&N. | Metre | 105700 |
| 29-409 | Same as item 29-405, but 2500A TP&N. | Metre | 128550 |
| 29-410 | Same as item 29-405, but 3200A TP&N. | Metre | 169650 |
| | **Auto Transfer Switch (ATS)** | | |
| 29-411 | ATS Panel, ATP & N made out of114 SWG M.S Sheet, **paif!lted** with electro static powder coated (paint,RAL-7032ATS fP.anels), <complete in all respect 1O KVA. | Each | 80236 |
| 29-412 | Same as item 29-411, but 15 KV/A. | Each | 83185 |
| 29-413 | Same as item 29-411, but 20 :KVA. | Each | 87397 |
| 29-414 | Same as item 29-411, but 30 KVA. | Each | 96947 |
| 29-415 | Same as item 29-411, but 40 KV . | Each | 103543 |
| 29-416 | Same as item 29-411, but 50 'KVA. | Each | 115945 |
| 29-417 | Same as item 29-411, but 60 KVA. | Each | 124603 |
| 29-418 | Same as item 29-411, but 75 KVA. | Each | 136537 |
| 29-419 | Same as item 29-411, but 100 KVA. | Each | 147769 |
| 29-420 | Same as item 29-411, but 125 KV-A. | Each | 228662 |
| 29-421 | Same as item 29-411, but 150 KVA. | Each | 258848 |
| 29-422 | Same as item 29-411, but 175 KVA. | Each | 282248 |
| 29-423 | Same as item 29-411, but 200 KVA. | Each | 363095 |
| 29-424 | Same as item 29-411, but 250 KVA. | Each | 407555 |
| 29-425 | Same as item 29-411, but 300 KVA. | Each | 450000 |
| 29-426 | Same as item 29-411, but 400 KVA. | Each | 650000 |
| 29-427 | Same as item 29-411, but 500 KVA. | Each | 1500000 |
| 29-428 | Same as item 29-411, but 600 KVA. | Each | 1600000 |
| 29-429 | Same as item 29-411, but 700 KVA. | Each | 1627613 |
| 29-430 | Power Quality Network Analyser 92192mm, PQM-1000S. | Each | 45000 |

| SI NO | Description | Unit | Rate (Rs) |
|---|---|---|---|
| 29-431 | Combined over current and earth fault relay, 92 /92 mm, DP-34. | Each | 100000 |
| 29-432 | Earth leakage relay 92 / 92 mm, DP-10. | Each | 25000 |
| 29-433 | High voltage detector, 3 KV, 224 KV. | Each | 55000 |
| 29-434 | DC Invertor type ACs spilt unit, consists of indoor unit, wall mounted type and outdoor unit, including installation kit, 1 Ton capacity (heat and cool). | Each | 116400 |
| 29-435 | Same as item 29-434, but 1.5 ton capacity. | Each | 186400 |
| 29-436 | Same as item 29-434, but 2.5 ton capacity. | Each | 369000 |
| 29-437 | Wall mounted spilt type, air conditioner 1 Ton Capacity with installation kit, Cool only. | Each | 75000 |
| 29-438 | Same as item 29-437, but 1.5 Ton. | Each | 95000 |
| 29-439 | Same as item 29-437, but 2 Ton. | Each | 120000 |
| 29-440 | Wall mounted spilt type, air conditioner, 1 Ton Capacity with installation kit, heat and cool. | Each | 90000 |
| 29-441 | Same as item 29-440, but 1.5 Ton. | Each | 110000 |
| 29-442 | Same as item 29-440, but 2.5 Ton. | Each | 135000 |
| 29-443 | Floor standing type unit, Air conditioner, 2 Ton HeaUCool. | Each | 295000 |
| 29-444 | Same as item 29-443 but 3 ton. | Each | 350000 |
| 29-445 | Same as item 29-443 but 4 ton. | Each | 420000 |
| 29-446 | Air conditioner, Split type floor mounted metal body, 3 phase 400 Volts capacity 5 Ton Cooling only. | Each | 350000 |
| 29-447 | Same as item 29-446 but 10 Ton. | Each | 624000 |
| 29-448 | Same as item 29-446 but 16 Ton. | Each | 1040000 |
| 29-449 | Same as item 29-446 but 20 Ton. | Each | 1300000 |
| 29-450 | Same as item 29-446 but 25 Ton. | Each | 1664000 |
| 29-451 | Air conditioner, Split type floor mounted metal body, 3 phase 400 Volts capacity 5 Ton Heat and Cool. | Each | 410000 |
| 29-452 | Same as item 29-451 but 10 Ton. | Each | 660000 |
| 29-453 | Same as item 29-451 but 16 Ton. | Each | 1080000 |
| 29-454 | Same as item 29-451 but 20 Ton. | Each | 1350000 |
| 29-455 | Same as item 29-451 but 25 Ton. | Each | 1715000 |

# SECTION - 30

# CALCULATION SHEET FOR CEMENT

# RECORD OF AMENDMENTS

| `SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION-30
# CALCULATION SHEET FOR CEMENT

| Sl No | Description | Unit | Bags 50 Kg |
|---|---|---|---|
| | **PCC** | | |
| 30-1 | PCC **3000 PSI** | Bag | 6.60 |
| 30-2 | PCC **3500 PSI** | Bag | 8.40 |
| 30-3 | PCC **4000 PSI** | Bag | 8.56 |
| 30-4 | PCC **4500 PSI** | Bag | 8.70 |
| 30-5 | PCC **5000 PSI** | Bag | 9.50 |
| 30-6 | PCC **6000 PSI** | Bag | 9.60 |
| 30-7 | PCC **6500 PSI** | Bag | 9.80 |
| 30-8 | PCC **600 PSI** ( **PQC Flexural Strength)** | Bag | 9.80 |
| 30-9 | PCC **(1:1.5:3)** | Cum | 8.31 |
| 30-10 | PCC **(1:2:4)** | Cum | 6.54 |
| 30-11 | PCC **(1:3:6)** | Cum | 4.57 |
| 30-12 | PCC **(1:4:8)** | Cum | 3.51 |
| 30-13 | PCC **(1:6:12)** | Cum | 2.40 |
| 30-14 | **Solid/ Hollow Blocks** of all sizes, set in CM (1:6) | Cum | 0.31 |
| 30-15 | PCC (1:3:6) in wall, copings, sills etc. setting, jointing and pointing in CM (1:4). | Cum | 4.84 |
| 30-16 | PCC (1:2:4) in wall, copings, sills etc. setting, jointing and pointing in CM (1:4). | Cum | 6.81 |
| | **Brick Work** In CM | | |
| 30-17 | Burnt Brick Work in CM (1**:6),** more/less than 6 m radius. | Cum | 1.40 |
| 30-18 | Burnt Brick Work in CM (1**:4),** more/less than 6 m radius. | Cum | 1.95 |
| 30-19 | Burnt Brick Work in **CM (1:3),** )n,qre/less than 6 m radius. | Cum | 2.44 |
| | **Pointing .. Brick Work** | | |
| 30-20 | Pointing Brick Work (flush), in **CM (1:3).** | Sqm | 0.05 |
| 30-21 | Pointing Brick Work (flush), in **CM (1:4).** | Sqm | 0.04 |
| 30-22 | Pointing Brick Work (flush}, in **CM (1:6).** | Sqm | 0.03 |
| 30-23 | Pointing Brick Work (struck), in **CM (1:1**). | Sqm | 0.10 |
| 30-24 | Pointing Brick Work (struck), in **CM (1:2).** | Sqm | 0.06 |
| | **Stone Masonry** | | |
| 30-25 | **Random Rubble masonry,** in **CM (1:4).** | Cum | 2.00 |
| 30-26 | Random Rubble masonry, in **CM (1:6).** | Cum | 1.42 |
| 30-27 | **Pointing in CM (1:3),** flush to Stone masonry. | Sqm | 0.07 |
| 30-28 | Pointing in **CM (1:4),** flush to Stone masonry. | Sqm | 0.06 |
| 30-29 | Pointing in **CM (-1:1),** flush to Stone masonry. | Sqm | 0.14 |
| 30-30 | **Doors, windows sills, steps** etc. set in CM (1:4). | Sqm | 2.10 |

| Sl No | Description | Unit | Bags 50 Kg |
|---|---|---|---|
| | **Tiles** | | |
| 30-31 | Facing, Machine made tiles. | Sqm | 0.23 |
| 30-32 | Single layer of **300 mm x 150 mm x 50 mm, flat Brick tiles** in CM (1:3). | Sqm | 0.033 |
| 30-33 | Same as item 30-40, but **38mm thick.** | $qm | 0.021 |
| 30-34 | Single layer of **300 mm x 150 mm x 50 mm (1:2:4) tiles,** in CM (1:3). | Sqm | 0.35 |
| 30-35 | Two layers of **300 mm x 150 mm x 50 mm flat Brick tiles,** setting and pointing in CM (1:3). | Sqm | 0.099 |
| 30-36 | One layer of **300 mm x 150 mm x 50 mm flat Bricks tiles** bedded, jointed and pointed in CM (1:3) including 300 x 75 x115 mm, perforated CC (1:2:4) tiles, set in CM (1:3). | Sqm | 0.16 |
| 30-37 | One layer of **300 x 300 x 50 mm PCC (1:2:4),** Pre cast tiles, bedded, jointed and pointed in CM (1:3), including CC (1:2:4) perforated tiles, 300 x 75 x 100 mm, set in CM (1:3). | Sqm | 0.61 |
| 30-38 | **Terrazzo (1:2), 10 mm thick.** | Sqm | 0.214 |
| 30-39 | Terrazzo (1:2), **13 mm thick.** | Sqm | 0.266 |
| 30-40 | Terrazzo (1:2), **20 mm thick.** | Sqm | 0.350 |
| 30-41 | **Glazed/Matt/Textured/Porcelain tiles** in wall/ floor. | Sqm | 0.06 |
| 30-42 | **Mosaic / Marble/Granite floor tiles,** laying only set in **CM (1:2).Cement Plaster.** | Sqm | 0.119 |
| 30-43 | **Cement plaster (1:6), 13 mm thick.** | Sqm | 0.087 |
| 30-44 | Cement plaster **(1:4), 13 mm thick.** | Sqm | 0.12 |
| 30-45 | Cement plaster **(1:3), 13 mm thick.** | Sqm | 0.15 |
| 30-46 | Cement plaster **(1:6), 19 mm thick.** | Sqm | 0.116 |
| 30-47 | Cement plaster **(1:4), 19 mm thick.** | Sqm | 0.16 |
| 30-48 | Cement plaster **(1:3), 19 mm thick.** | Sqm | 0.20 |
| 30-49 | **Rough cast cement plaster (1:2), 13 mm thick.** | Sqm | 0.155 |
| 30-50 | Rough cast cement plaster (1:2), **19 mm thick.** | Sqm | 0.22 |
| 30-51 | Rough cast cement plaster (1:2), **6 mm thick.** | Sqm | 0.0714 |
| 30-52 | Cement slurry wash | Sqm | 0.14 |
| 30-53 | Surface gullies as per SI 21-19. | Each | 0.67 |
| 30-54 | Cleaning Eyes as per SI 21-18. | Each | 0.66 |
| | **Manholes** | | |
| 30-55 | Manholes, not exceeding 600 mm in depth of **burnt Brick Work** in CM (1:3), 230 mm walls. | Each | 5.13 |
| 30-56 | Manholes, not exceeding 600 mm in depth of **PCC (1:3:6),** 230 mm walls. | Each | 6.95 |
| 30-57 | Manholes, not exceeding 600 mm in depth of **Stone masonry** in CM (1:3), 300 mm walls. | Each | 5.40 |
| 30-58 | Manholes, not exceeding 600 mm in depth, **RCC (1:2:4),** 150 mm walls. | Each | 5.70 |
| 30-59 | Manholes, exceeding 600 mm but not exceeding 1800 mm in depth of **burnt Brick Work** in CM (1:3), 230 mm walls. | Each | 7.40 |
| 30-60 | Manholes, exceeding 600 mm but not exceeding 1800 mm in depth, **PCC (1:3:6),** 230 mm walls. | Each | 9.63 |
| 30-61 | Manholes exceeding 600 mm, but not exceeding 1800 mm in depth, **Stone masonry** in CM (1:3), 300 mm walls. | Each | 8.59 |
| 30-62 | Manholes exceeding 600 mm, but not exceeding 1800 mm in depth, **RCC (1:2:4),** 150 mm walls. | Each | 9.05 |

# SECTION - 31

# LABOUR RATES

# RECORD OF AMENDMENTS

| `SI No | AMENDMENT | AUTHORITY |
|---|---|---|
| | | |
| | | |
| | | |

# SECTION 31

## LABOUR RATES

These Labour Rates have been used in compiling the item rates in this Schedule and shall be used in accordance with the General Rules, where applicable.

| Sl No | Description | Rate per day (Rs) |
|---|---|---|
| 31-1 | Aluminum Fixer | 1500 |
| 31-2 | Black Smith | 1400 |
| 31-3 | Mason {Brick-Layer) | 1400 |
| 31-4 | Cabinet maker | 1400 |
| 31-5 | Cable jointer | 1500 |
| 31-6 | Carpenter | 1400 |
| 31-7 | Carpenter boy | 800 |
| 31-8 | Chowkidar | 1000 |
| 31-9 | Electrician | 1500 |
| 31-10 | Fitter Mechanic | 1500 |
| 31-11 | Gas Fitter | 1500 |
| 31-12 | Glazier | 1400 |
| 31-13 | Hammer-man | 800 |
| 31.-14 | Labour | 800 |
| 31-15 | Labour Electric | 1200 |
| 31-16 | Line Man | 1500 |
| 31-17 | Mali | 1000 |
| 31-18 | Painter | 1400 |
| 31-19 | Pipe Fitter | 1500 |
| 31-20 | Plumber | 1400 |
| 31-21 | Polisher / Grinder | 1400 |
| 31-22 | Roof Tiler | 1400 |
| 31-23 | Sanitary Worker | 1000 |
| 31-24 | Sawyer | 1300 |
| 31-25 | Sign-Writer | 1400 |
| 31-26 | Stone Breaker | 1000 |
| 31-27 | Mason {Stone work) | 1400 |
| 31-28 | Supervisor | 1500 |
| 31-29 | Tile Fixer {for floor and wall tiles work, any type, glazed / unglazed, ceramic, porcelain, marble, granite, vinyl etc). | 1600 |
| 31-30 | Tin smith | 1500 |
| 31-31 | Up-holster | 1400 |
| 31-32 | Welder | 1400 |
| 31-33 | Well Sinker - In charge | 1300 |
| 31-34 | Wire man | 1500 |
| 31-35 | X-Ray Welder | 1750 |

# INDEX

# INDEX


| S.No | Description | Page Reference |
|---|---|---|
| | **SECTION -1** | |
| 1 | **Excavation and Earth Work** | **1-10** |
| 2 | Classification of Excavation | 1,9 |
| 3 | Classification of Soils | 5 |
| 4 | Mechanical Excavation for Rocks | 1,2 |
| 5 | Borrow pit | 1 |
| 6 | Measures (Solid, Loose, Packed, Conversion factors) | 2 |
| 7 | Compaction | **2,3** |
| 8 | Survey and Setting out profiles | 5 |
| 9 | Measurement for Excavation and Earth work | 3,9 |
| 10 | Earth filling under Floors / Area | 3 |
| **11** | Transportation of Spoils and Materials, Lead | 4 |
| 12 | Stripping | 5 |
| 13 | Removal of trees | 5 |
| **14** | Clearing and Grubbing | 5 |
| 15 | Making Embankment | 6 |
| **15-1** | - Formation of Embankment with Borrow Excavation | 6,7 |
| **15-2** | - Formation of Embankment on Steep Slopes | 7 |
| **15-3** | - Formation of Embankment on Existing roads | 7 |
| **15-4** | - Formation of Embankment in Waterlogged areas | 7,8 |
| 16 | Compaction of Natural Ground | 5 |
| 17 | Formations from Borrow Excavations, Roadway Excavations and Structural Excavations | 8 |
| | **SECTION -2** | |
| 18 | **Roads and Runways** | **11-33** |
| 19 | Sub Base | 11,31 |
| 20-1 | - Sub Base - Granular | 11,31 |
| 20-2 | - Sub Base - Soil Aggregate (Ghera) | 11,12,31 |
| 20 | Base | 12,31 |
| **21-1** | - Base - Aggregate Base course | 12,13,31 |
| **21-2** | - Base - Water Bound Macadam (WBM) | 13,14,31 |
| 21 | Bituminous Surface Treatment | 14,15,31 |
| 22 | Asphaltic Materials for Surface treatment | 15,16 |
| 23 | Procedure for Bituminous Surface Treatment | 15,16,17 |
| 24 | Premix Carpet (Bit-Mac) | 17,18,19,32 |
| **24-1** | - Quantity of material for Premix Carpet (Bit Mac) | 18 |
| 25 | Prime/ Tack/ Seal Coat | 19,20 |
| 26 | Asphaltic Courses (Plant Mix) | 20,21,22 |
| **26-1** | - Asphaltic Base Course | 20,21,22,23 |
| 26-2 | - Asphaltic Wearing Course | 23,32 |
| 27 | Concrete Pavements - Roads | 25,32 |
| 28 | Formation | 25,31 |
| 29 | Cut/ fill | 31 |
| 30 | Compaction | 31 |
| 31 | Bottoming / Sub Base | 31 |
| 32 | Rapid Runway Repairs | 26,32 |
| 33 | Joint Sealants / Fillers | 26,32 |
| 34 | Asphalt Wearing Course for runways / taxi ways | 27,32 |
| 35 | New Jersey Barrier | 27,30,33 |
| | **SECTION -3** | |
| 36 | **Concrete** | **34-47** |
| 37-1 | - Normal Concrete - Non Structural Concrete | 34,35 |
| 37-2 | - Special Concrete - Structural Concrete | 34,45 |
| 37 | Material Requirements | 34 |
| 38-1 | - Cement (Types and Properties) | 34,35,36 |
| 38-2 | - Aggregates | 36 |

| S.No | Description | Page Reference |
|---|---|---|
| 38-3 | - Water | 37 |
| 38-4 | - Admixture | 37 |
| 38 | Sulfate Resistant Cement | 34,35,36 |
| 39 | Water - Cement Ratio | 38 |
| 40 | Handling, Placing, Depositing | 38, 39 |
| 41 | Curing Concrete | 39 |
| 42 | Testing of Concrete | 40 |
| 43 | Reinforced Concrete | 45 |
| 44 | Construction and Expansion Joints | 40,41 |
| 45 | Form work | 41,42 |
| 46 | Pre-cast Concrete | 42 |
| 47-1 | - Concrete Blocks | 42,46 |
| 47-2 | - Kerbs Stones | 42,43,46 |
| | **SECTION-4** | |
| 47 | **Brick Masonry** | **48-53** |
| 48 | Bricks (Type, sizes, properties) | 48,51 |
| 49 | Brick work (Burnt bricks) | 48,51,52 |
| 50 | Mortar (Cement , Mud) | 49 |
| 51 | Pointing | -52,,53,54 |
| 52 | Brickwork in Cavity wall | 49,52 |
| 53 | DPC | 53 |
| | **SECTION-5** | |
| 54 | **Stone Masonry** | **54-56** |
| 55 | Properties of Stones | 54 |
| 56 | Stone Walling | 54 |
| 57 | Random Rubble brought upto Courses | 55 |
| 58 | Stone masonry | 55,56 |
| 59 | Pointing- stone masonry | 55,56 |
| 60 | Boulders in Crates, Pitching etc | 56 |
| | **SECTION -6** | |
| 61 | **Wood work** | **57-64** |
| 62 | Timber | 57,63 |
| 63 | Classification of Timber | 57,58,63 |
| 64 | Grading of Timber | 57 |
| 65 | Selection of Timber | 58 |
| 66 | Properties of Timber | 58,59 |
| 67 | Boarding (Hard / Soft), Chip board etc | 63 |
| 68 | Timbering | 61 |
| 69 | Old Roof Trusses | 63 |
| 70 | Trellis work, Moulding and Turned work | 63,64 |
| 71 | Jobbing work | 62,64 |
| | **SECTION-7** | |
| 72 | **Doors & Windows** | **65-80** |
| 73 | Frames and Chowkats | 65 |
| 74 | MDF | 65,74 |
| 75 | Glass | 65 |
| 76 | Wooden Doors | 65,73 |
| 76-1 | - Panelled Doors | 65,73 |
| 76-2 | - Framed Panelled Partitions & Dados | 65,73,74,78 |
| 76-3 | - Half glazed doors | 65,73 |
| 76-4 | - Flush doors (Solid, Hollow) | 65 |
| 76-5 | - Hold fasts | 66,69,70 |
| 76-6 | - Preservatives | 66 |
| 76-7 | - Mongery | 66 |
| 77 | Aluminium Doors & Windows | 68,75,76 |
| 77-1 | - Sliding / Swing Doors | 68,75,76 |
| 77-2 | - Sliding/ Fixed Windows | 76,77,78 |
| 77-3 | - Fly Screens | 68,78 |
| 77-4 | - Standard Hardware | 68,69 |

| S.No | Description | Page Reference |
|---|---|---|
| 78 | u PVC, Doors & Windows | 75,77 |
| 79 | Steel Chowkats | 69,75 |
| 80 | Dolly Frame Chowkats | 75 |
| 81 | Kitchen Cabinet | 69,77 |
| 82 | Box Type Windows | 71,77 |
| 83 | Jobbing Work - Doors / Windows | 78, 79,80 |
| 84 | Glass Partition and Door | 77 |
| | **SECTION - 8** | |
| 85 | **Mongery** | **81-88** |
| 86 | Tower bolts | 81,83 |
| 87 | Hinges, Spring Hinges | 81,83 |
| 88 | Latches | 82,85 |
| 89 | Locks (Rim , Ordinary cup board) | 82,85 |
| 90 | Handles | 82,86 |
| 91 | Hooks | 82,86 |
| 92 | Hasp & Staple | 81,87 |
| 93 | Springs for Doors, Door Closer | 87 |
| 94 | Push & Kick plates | 87 |
| 95 | Aluminum Door- Locks & Closers | 88 |
| | **SECTION-9** | |
| 96 | **Plain & Corrugated Steel Sheets** | **89 -97** |
| 97 | Galvanizing | 89 |
| 98 | Steel & Iron | 89 |
| 99 | Pre stressing Steel | 90 |
| 100 | High Strength Alloy Steel bars | 90 |
| 101 | Bolts and Nuts | 90,91 |
| 102 | **XPM** | 95,96 |
| 103 | Steel Reinforcement | 91,92,95 |
| 104 | Structural Steel work | 89,94 |
| 105 | General Steel work | 89,94 |
| 106 | Welding | 95 |
| 107 | CI work | 95 |
| 108 | Wire for Fencing | 96,97 |
| 109 | Woven wire | 97 |
| 110 | Concertina coil / Razor wire | 97 |
| | **SECTION -10** | |
| 111 | **Roof Coverings & Treatments** | **98-107** |
| 112 | Plain / Corrugated sheets | 98,99,104,105 |
| 113 | Pattern Roofing / Slopping pattern | 98,99, 104,105 |
| 114 | Roof Treatments | 100, 101 |
| 114-1 | - Bitumen Felts | 100,106 |
| 114-2 | - Building Papers | 100,106 |
| 114-3 | - Membranes | 100 |
| 115 | Roof Insulations | 102,106 |
| 115-1 | - Brick Tiles | 102,105 |
| 115-2 | - Cement Tiles | 102,105 |
| 115-3 | - Poly Extruded Board | 102,106 |
| 116 | PVC Sheet Roofing | 107 |
| 117 | Aluminium sheets | 104 |
| 118 | Mud Roofs | 102,105 |
| | **SECTION -11** | |
| 119 | **Termite Treatment** | **108-109** |
| | **SECTION -12** | |
| 120 | **Flooring and** Tiling | **110-118** |
| 120-1 | - Terrazo | 110, 113 |
| 120-2 | - Terrazo (Mosaic) Tiles | 110,113,117 |
| 120-3 | - Glazed/ un-Glazed / Ceremic / Porcelain Tiles | 110,113,117 |

| S.No | Description | Page Reference |
|---|---|---|
| 120-4 | - PVC Tiles | 110,118 |
| 120-5 | - Marble Tiles | 110,117 |
| 120-6 | - Granite Tiles | 110,117 |
| 120-7 | - Sub Floors | 110,116 |
| 120-8 | - Floors | 113, 116 |
| 121 | Wall Cladding | 110,113, 118 |
| 121-1 | - Face Tiles / Artificial Stone | 118 |
| **121-2** | - Aluminium Composite Panels | 113,118 |
| 122 | Paving Stones | 112,113,114,116 |
| 123 | Screed on Bond Breaking Layer | 114,118 |
| **124** | Sodium Silicate Application | 114,115 |
| 125 | Flush Pointing | 118 |
| 126 | Floor Toping | 118 |
| 127 | Floor Polishing | 117 |
| 128 | Floor Grinding | 117 |
| 129 | Plinth Protection | 118 |
| | **SECTION -13** | |
| 130 | **Plastering** | **119 -121** |
| 131 | Plaster (Cement. mud) | 119,121 |
| 132 | Rough Cast Plaster | 121 |
| 133 | Scraping Plaster | 121 |
| 134 | Filleting | 121 |
| 135 | Dubbing out | 121 |
| | **SECTION-14** | |
| 136 | **Celling & Panellng** | **122-124** |
| 137 | Hard Board | 122,123 |
| 138 | Soft Board | 122,123 |
| 139 | Chip Board | 122,123 |
| 140 | Thermopore | 122,123 |
| 141 | Dampa Sheets | 122,123 |
| 142 | Fibre / Gypsum / Mineral Acoustic Sheets | 122,124 |
| 143 | POP | 122,123 |
| 144 | PVC, uPVC | 122,124 |
| 145 | MDF | 122,124 |
| | **SECTION-15** | |
| 146 | Finishes | **125-133** |
| 147 | Cement Slurry | 125,130 |
| 148 | Cement Oil Paint | 125 |
| 149 | Distemper | 125,130 |
| 150 | Whitening | 125,130 |
| 151 | Lime | 125,130 |
| 152 | Painting | 127 |
| 152-1 | - Painting - Wood work | 128,131,132 |
| 152-2 | - Painting- Steel and Iron Work | 128,131,133 |
| 152-3 | - Aluminium Painting | 131 |
| 153 | Oiling Woodwork | 127 |
| 154 | Camouflage Paint | 127,133 |
| 155 | Epoxy Coating/ paint for POL Tanks | 127,129,132,133 |
| 156 | Weather Resistant Paint | 132 |
| 157 | Wall paper | 128,132 |
| 158 | Wall Coatings | 129,132,133 |
| i59 | Acrylic Based Paint | 129,132,133 |
| 160 | Textured Coatings( Roll on, Zola, Graffito etc) | 129,133 |
| 161 | Wood Preservatives | 129 |
| 162 | Tarring | 129,130 |
| 163 | Painting on Plastered Wall- Alkali Resistant Paint | 128 |
| 164 | Burning Old Paint | 132 |
| 165 | Polishing | 132 |

| S.No | Description | Page Reference |
|---|---|---|
| 166 | Road Marking Paint | 123,132 |
| | **SECTION -16** | |
| 167 | **Glazing** | **134-135** |
| 168 | Putty | 134,135 |
| 169 | Sheet Glass (Plain, Frosted, Tinted) | 134,135 |
| 170 | Plate Glass (Plain, Frosted, Tinted) | 134,135 |
| 171 | Glass Blocks/ Tiles (Plain, Coloured) | 135 |
| 172 | Fixing Sheet Glass | 135 |
| 173 | Tempered Glass | 135 |
| 174 | Hacking out | |
| | **SECTION -17** | |
| 175 | **Sanitary Fittings** | **136-141** |
| 176 | Sanitary Ware | 136,139 |
| 177 | Sanitary Fittings | 136,139 |
| 178 | Traps | 140,141 |
| 179 | Workmanship | 137 |
| 180 | Joints | 137,138 |
| 181 | Ceramic Sanitary Ware | 139,140 |
| 182 | we, Urinal | 139 |
| 183 | Sink Scullery | 139 |
| 184 | WHB | 140 |
| 185 | Mirror | 140 |
| 186 | Bath Accessories | 140,141 |
| 187 | Vanity Bowl | 141 |
| 188 | we Seat Cover | 141 |
| | **SECTION-18** | |
| 189 | **Water** Supply, **Pipes/** Fittings (GI,MS,tPv'C,PPR,PE) | **142-178** |
| 190 | GI/ MS, Water Quality Pipes | 142,152,153,154 |
| 191 | GI Fittings, Sockets, Bends, Elbows, Tees, Check nut, Plugs, Bib cocks, Lavatory cocks etc | 155,156,157,158,159 |
| 192 | Sluice Valves | 145,161 |
| 193 | Other Valves / Brass Spindle | 151,162,163 |
| 194 | Water Meters | 147,174,175,176,177,178 |
| 195 | PPR, Pipes and Fittings | 160 |
| 196 | PE, Pipes and Fittings | 149, 165 to 174 |
| 197 | Back filling | 150 |
| 198 | Plumber's Brass work | 152 |
| 199 | Canvas Pipe | 159 |
| 200 | Disinfection of Water Supply System | 152 |
| 201 | Testing of Water Supply System | 152 |
| 202 | Fire Hydrant | 163 |
| 203 | Flanges | 163,164,173 |
| 204 | Water Tanks (PE) | 164,165 |
| 205 | Water Coolers | 165 |
| 206 | Water Filters | 165 |
| | **SECTION -19** | |
| 207 | **Water Supply - Installations** | 179-188 |
| 208 | Blind Pipes and Casing | 179 |
| 209 | Strainers / Filters | 179 |
| 210 | Water Supply Pumping sets | 179 |
| 211 | Chlorinators | 179 |
| 211-1 | - Standard Chlorinators | 179 |
| 211-2 | - Hypo-Chlorinators | 179 |
| 212 | Chlorine Gas Cylinder | 180 |
| 213 | Tube Well Drilling / Boring | 180 |
| 213-1 | - Hydraulic Drilling | 180. |
| 213-2 | - Percussion Drilling | 180 |

| S. No | Description | Page Reference |
|---|---|---|
| 214 | Trial Bore | 181 |
| 215 | Well Development | 180, 184 |
| 216 | Well Sterilization | 180, 184 |
| 217 | Well Measurement | 181 |
| 218 | Centrifugal pumps | 182 |
| 219 | Deep well Turbines | 184 |
| 220 | Submersible Pumps | 185 |
| 221 | Reciprocating Pumps | 187 |
| 222 | Motor-Electric | 187 |
| 223 | Extra Column pipes | 185 |
| 224 | Disinfection of Water Pipelines | 188 |
| 225 | Sluice Valves (Oil Quality) | 187 |
| 226 | Mono Block Pumping Set | 188 |
| 227 | Pressure Switch Complete | 188 |
| 228 | Water Purification Plant 1000/500 gln | 188 |
| | **SECTION - 20** | |
| 229 | **Internal sewerage** | **189-198** |
| 230 | CI Pipes (SWV) Spun and Fittings | 189, 195, 196 |
| 231 | Inlet Ventilation | 189 |
| 232 | u PVC (Non Pressure type like NAKASI) SW pipe and Fittings | 189, 190, 196, 197, 198 |
| 233 | u PVC Vent Pipes and Fittings | 189, 196 |
| 234 | u PVC - Jointing Techniques | 191, 192, 193, 194 |
| | **SECTION - 21** | |
| 235 | **External Sewerage and Drainage** | **199-207** |
| 236 | RCC Pipes (BSS) | 199, 205 |
| 237 | RCC Pipes (ASTM) | 200, 205 |
| 238 | Sludge Pumps | 201, 207 |
| 239 | Submersible Pumps (for drainage, fountains, de-watering) | 201, 207 |
| 240 | Laying of RCC Pipes | 201 |
| 241 | Interception Chambers | 202 |
| 242 | Gullies | 202, 205 |
| 243 | Manholes | 202, 205 |
| 244 | Manhole Covers | 202, 203, 206 |
| 245 | Testing of Drains / Pipes (Smoke Test etc) | 202 |
| 246 | Sinking of Well | 206 |
| 247 | Taking up Glazed pipes | 206 |
| | **SECTION - 22** | |
| 248 | **Pre Engineered Construction** | **208-221** |
| 249 | Pre cast Conventional Roofing System | 208, 220 |
| 250 | Single / Double Tee beam | 208, 214, 215, 216 |
| 251 | Pre Cast Inverted 'T" and "L" beams | 208, 215, 216, 217 |
| 252 | Precast Girders | 208, 216 |
| 253 | Precast Slabs | 208, 209, 211, 215 |
| 254 | Hollow Core Slab | 209, 210, 221 |
| 255 | Pre Engineered Construction System | 211 |
| 256 | Pre cast Concrete Boundary Wall system | 209, 221 |
| 257 | Pre Cast / Pre- Engineered Structures | 210 |
| 258 | Steel "K" Span | 218, 219, 221 |
| | **SECTION - 23** | |
| 259 | **Demolition & Dismantling** | **222-224** |
| 260 | Damage | 222 |
| 261 | Cutting Opening through Wall | 222 |
| 262 | Demolition of Concrete | 222 |
| 263 | Demolition of Wall , Foundations | 222 |
| 264 | Removing Mud from roof | 223 |
| 265 | Demolition of Floors | 223 |

| S.No | Description | Page Reference |
|---|---|---|
| 266 | Demolition of Wood work | 223 |
| 267 | Demolition of Iron and Steel | 223 |
| 268 | Dismantling of Roof | 223,224 |
| 269 | Taking down Plumbing and Drain | 224 |
| 270 | Miscellaneous Demolition | 224 |
| | **SECTION-24** | |
| 271 | **Internal Electrification** | **225-260** |
| 272 | Electrification Standard Requirements | 225 |
| 273 | Material Specifications | 225 |
| 274 | Siting of Electrical Equipment in Buildings | 225 |
| 275 | Mounting of Fittings and Accessories | 225 |
| 276 | Wiring | 225 |
| 276-1 | - PVC Channel Putty | 235 |
| 276-2 | - PVC Conduit Wiring | 235 |
| 276-3 | - Surface Conduit Wiring | 235 |
| 276-4 | - Concealed Conduit Wiring | 235 |
| 276-5 | - Flame proof Conduit wiring | 235 |
| 276-6 | - Point Wiring | 235 |
| 286-7 | - External Wiring | 235 |
| 277 | Main Control | 228 |
| 278 | Earth Neutral Conductor | 228 |
| 279 | Portable Appliances | 228 |
| 280 | Earthing | 228 |
| 281 | Meters - Electric | 229 |
| 282 | Switch Connections | 229 |
| 283 | Bus Bar Chamber | 247 |
| 284 | Lightning Conductor | 229,232 |
| 285 | Electrical Tests | 230 |
| 286 | Samples | 230 |
| 287 | Fittings & Accessories for Pendants | 240 |
| 288 | Lamp holder | 240 |
| 289 | LED Lights | 240 |
| 290 | Bulk Head Fittings | 243 |
| 291 | MCCB, SP, TP and 4 Pole | 245,246 |
| 292 | Board Distribution | 256 |
| 293 | Conduits | 251 |
| 294 | Fan work | 248 |
| 295 | Electric Motors | 249 |
| 296 | Geyser - Electric | 256 |
| 297 | Rewinding | 250 |
| 298 | Starters | 250 |
| 299 | Flame proof ltings | 244 |
| 300 | Exhaust Fans | 254 |
| 301 | Lawn / Garden Lights | 258 |
| 302 | Air Compressors | 255 |
| 303 | Pumping set for fuel | 255 |
| 304 | Change over Switch | 245 |
| 305 | Circuit Breakers | 245,246 |
| 306 | Bell Push/ Electric, Buzzer | 248 |
| 307 | Box / Board Junction | 251 |
| | **SECTION- 25** | |
| 308 | **External Electrification** | **261-321** |
| 309 | Electrical Standards | 261 |
| 310 | Equipment | 261 |
| 311 | Aerial Line | 265 |
| 311-1 | - Height from Ground | 265 |

| S.No | Description | Page Reference |
|---|---|---|
| 311-2 | - Earthing of Metal Supports | 265 |
| 311-3 | - Factor of Safety | 266 |
| 311-4 | - Line Crossing or Approaching Each other | 266 |
| 311-5 | - Protection from Lightning | 266 |
| 311-6 | - Spacing of Conductors | 267 |
| 311-7 | - Conductors of Different Pressure - Same support | 266 |
| **311-8** | - Dip | 266 |
| 311-9 | - Sag | 266-267 |
| 311-10 | - Steel Tubular Poles | 267 |
| 311-11 | - Lattice Steel Poles ('L' Type and 'H' Type) | 270,288,289,295 |
| 311-12 | - Stringing of Conductors | 271 |
| 311-13 | - Testing of Overhead Line- Sample Tests | 269,270,271 |
| 311-13 | - Conical/ Octagonal Pole 9,10, 12 Meter | 282,283,284,285,294,295 |
| 312 | Under Ground System | 272 |
| 312-1 | - Excavation of Trenches | 272 |
| 312-2 | - Laying of Cables | 272 |
| 312-3 | - Jointing of Cables | 272 |
| 312-4 | - Crossing Roads, Pavements, Culverts, Bridges | 272 |
| 312-5 | - Tests | 276 |
| **313** | Siting of External Services to Important Buildings | 276 |
| 314 | Stays, stay wires | 271,296,311 |
| 315 | Copper Conductors | 296 |
| 316 | Aluminium Conductors | 297 |
| 317 | Cable Electric - HT, LT, 4 Core, 3 Core, Sin!:)le Core Copper/ Aluminium | 297 to 306 |
| 318 | PVC Joints | 306to311 |
| 319 | PVC Tennination Kit | 306 |
| 320 | Non Climbable Device | 292,310 |
| 321 | Lightning Arrestor | 310 |
| 322 | Service Connection | 310 |
| 323 | Steel Box - Main Switch | 311 |
| 324 | Fuse - Aerial | 311 |
| 325 | Guards | **211** |
| 326 | Jumprings .. | 311 |
| 327 | Power Transfonner, Pad Mounted, Dry Type Transfonner | 261,312,313,314,315 |
| 328 | Current Transformer | 315 |
| 329 | Potential Transfonner | 315 |
| 330 | HT Switch Gear | 317 |
| 331 | Voltage Regulator (AVR etc) | 316,317 |
| 332 | LED Road Street Light | 320 |
| 333 | LED Flood Light | 320,321 |
| 334 | Earth for Transfonner | 265,317 |
| 335 | VCBs | 317 |
| 336 | Feeder Pillar Cabin | 318 |
| | | |
| | **SECTION-26** | |
| 337 | **Natural Gas** | **322-334** |
| 338 | High Pressure Gas Pipe work | 322 |
| 339 | Low Pressure Gas Pipe work | 322 |
| 340 | Medium Density Poly Ethylene, High Pressure Gas Pipe, (MOPE) | 324 |
| 341 | Jointing of MOPE Pipe | 324 |
| 341-1 | - Butt Fusion | 325 |
| 341-2 | - Electro Fusion | 325 |
| 342 | Location of Gas Points | 327 |
| 343 | Location of Gas Appliances | 326 |

| S. No | Description | Page Reference |
|---|---|---|
| 344 | Sizing of House Pipes | 326 |
| 345 | House Piping Installation | 326 |
| 346 | Multiple Meter Installation | 326 |
| 347 | Underground Piping | 326 |
| 348 | Concealed Piping | 328 |
| 349 | Checking for Leakage | 327 |
| 350 | Shut off Valve/ Cock | 327 |
| 355-1 | - Meter Control Cock | 327 |
| 355-2 | - Manifold Cock | 327, 331 |
| 351 | Gas Room Heaters | 331 |
| 352 | Instant Gas Water Heater | 331 |
| 353 | Gas Water Heaters | 331 |
| 354 | Dual Action Gas cum Electric Water Heater | 342 |
| 355 | Inspection, Testing of Gas Lines | 328 |
| 356 | MS Pipe work | 322, 330 |
| 357 | MDPE Pipe work | 324, 333 |
| 358 | Gas Valves / Cocks | 330 |
| 359 | Tandoor / Burner | 331 |
| 360 | Gas Burner (Chullah) | 332 |
| 361 | Build in Buner | 332 |
| 362 | Gas Cooking Range | 332 |
| 363 | Micro hose (Fire resistant) | 332 |
| 364 | Sui Gas Meter | 330 |
| 365 | Thermostat | 332 |
| 366 | Muller Tee | 333 |
| 367 | Miscellaneous | 332 |
| | **SECTION – 27** | |
| 368 | **Electro Mechanical Equipments** | **335-381** |
| 369 | GI Ducting | 335 |
| 370 | Diffusers | 335 |
| 371 | Gate Valve | 335 |
| 372 | GI Sheet Metal Duct | 335 |
| 373 | Ducts Joints | 335 |
| 374 | Bracing | 335 |
| 375 | Bottom Support | 335 |
| 376 | Hanger | 336 |
| 377 | Table Insulation for Duct | 336 |
| 378 | Balancing Valve | 369 |
| 379 | Non-Return Valve | 369 |
| 380 | Y Strainer | 369 |
| 381 | Automatic Air Vent Valve | 369 |
| 382 | Installation AC Unit | 369 |
| 383 | Air Conditioning System | 337, 373 |
| 384 | VRF System | 347 |
| 385 | Package Type Air Conditioner | 347, 377 |
| 386 | Passenger / Cargo Elevator | 338 |
| 387 | Fire Extinguishing and Suppression System | 347, 377 |
| 388 | Public Address System | 381 |
| 389 | Crane | 378 |
| 390 | Diesel Generator Set | 379 |
| 391 | Medical Gases | 381 |
| 392 | Solar System | 382 |

MES as a department deals with designing, construction and maintenance of buildings, roads, airfields, bridges, electricity, water supply, gas, drainage, sewerage, furniture and stores etc. To handle all these services, MES has different cadres like Building & Roads (B&R), Electrical & Mechanical, (E&M) and Furniture & Stores (F&S). MES is an inter-services organization responsible to deliver such services for Army, Navy, Air Force and Defence Production. First MES Schedule of Rates was issued in 1948, thereafter it has been regularly revised from time to time.